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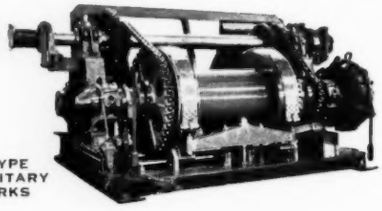

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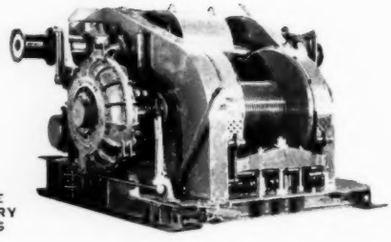

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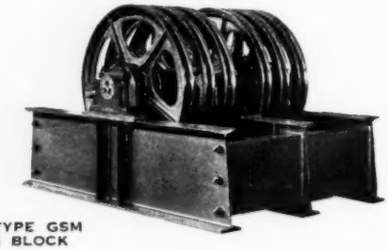

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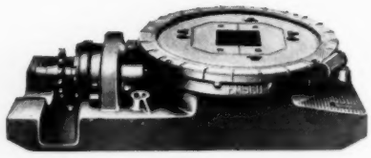

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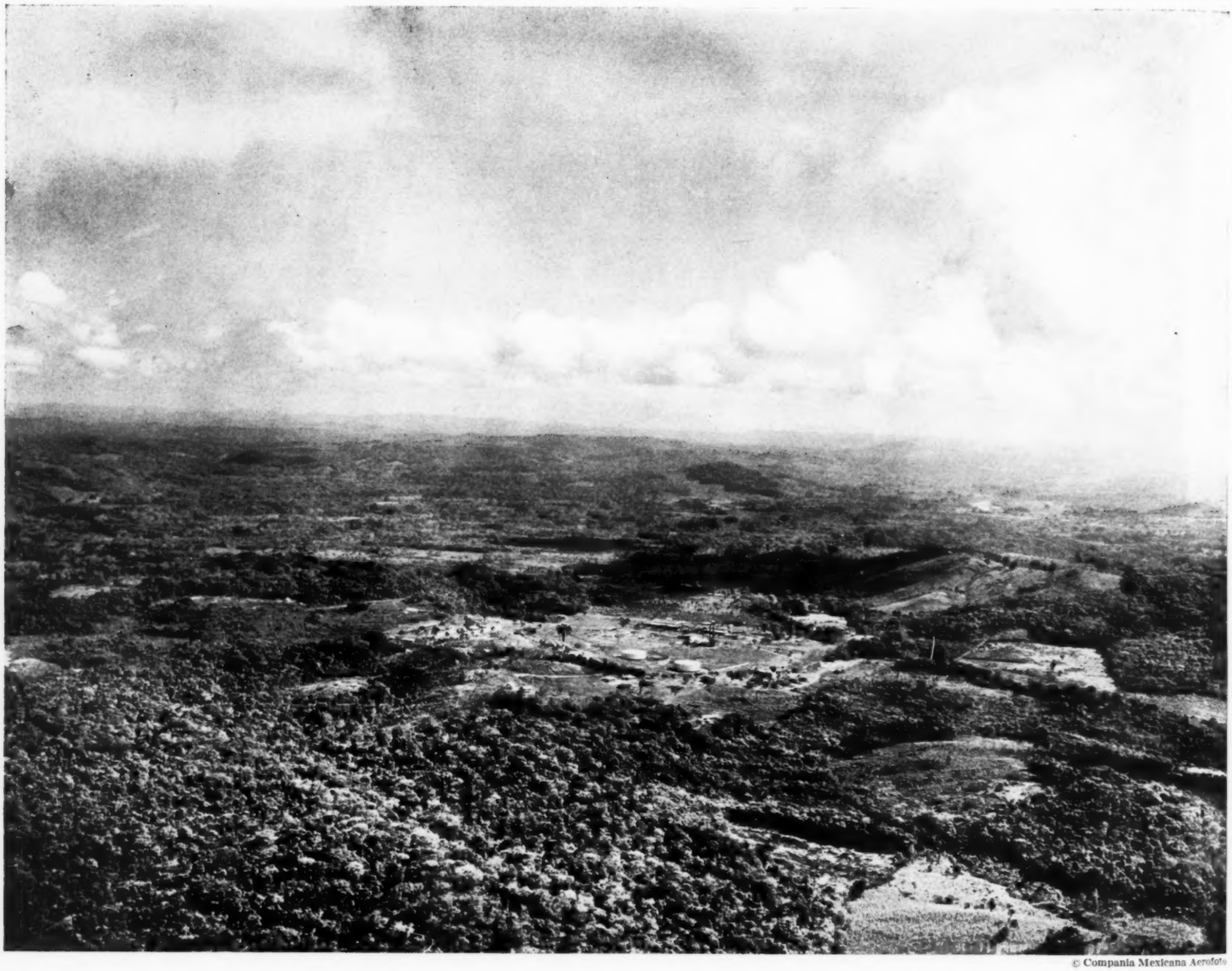

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Air view of the new Poza Rica field, covered with semi-tropical growth, 40 miles from the nearest deep water. Material is moved in over a narrow gauge railroad built by the company.

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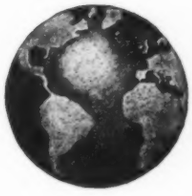

SEEKING obviously to conform to decision of the United States Supreme Court in the now celebrated Schecter case and to recognize the conflicting views of Congress and the Administration in the matter of federal control of petroleum, the Thomas bill for regulation of the oil industry has been practically rewritten. In its revised form it consents to an interstate compact and authorizes the approval of voluntary agreements for unit operation of fields. It still provides for the exercise of national authority through an administrative board appointed by the President though limiting the use of such power to occasions when the production of crude in any state exceeds the "reasonable market demand."

Modifying Control Plan

It is noteworthy that this effort to retain a degree of national control over petroleum accompanies a determined drive for other measures enlarging federal authority over business, particularly the Guffey bill to nationalize the coal industry. It is doubtful however whether the Thomas bill in its amended form will meet with much more favor than the original. Opposition to federal control has been growing, both outside and inside Congress, and that body appears to be more in a mood than formerly to resist dictation from the opposite end of the capital.

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TWENTY five years ago Mexico was the center of interest in the oil industry. The marvellous gushers of her "gold coast" were making records of production seldom dreamed of for individual wells. Fifteen years ago she ranked as the second largest producer of petroleum, being excelled only by the United States. Today Mexico has dropped to seventh place among oil producing countries, and instead of producing one quarter now produces but one fortieth of the world's output.

Mexico's Decline

Though the spectacular gushers of the early days are gone and all but forgotten the change in Mexico's position is not due to exhaustion of her petroleum resources. The known reserves of Mexican fields are placed at a higher figure today than they were a number of years ago. In the opinion of many oil men Mexico is still potentially one of the richest of petroleum bearing countries.

To understand the reason for the decline of Mexico's position in the oil world it is necessary to look to the legislative policy and procedure of the country's successive governments in relation to petroleum during the past decade and a half. The laws and regulations adopted from 1919 onward have had two main objectives. One has been to take the ownership and control of petroleum resources away from foreign owners and to place it in the hands of Mexican citizens. The other has been to divert to the government and to Mexican labor as large a share as possible of the returns from oil enterprises by heavy taxation and by encouraging labor to make exorbitant demands on the operators.

▼

IT is not to be assumed that the state officials responsible for Mexican petroleum policy wantonly sought to destroy the enterprises that had contributed so largely to the country's industrial activity. It is reasonable to believe that they felt that they were acting for their country's good. Unfortunately the measures adopted have been singularly unsuccessful in accomplishing the desired results. As Ing. José Noriega points out in his impartial analysis of the situation published on other pages of this issue the attempts to encourage nationalization through attacks on titles have resulted in decreasing instead of increasing the share of Mexican citizens in the country's oil industry. Oppressive taxation has eliminated more native owners than foreigners. Even labor has not profited by the constant succession of strikes since continuous employment at high wages is possible only in a stable industry.

Misdirected Policies

What has been accomplished is to minimize exploration, to create a state of uncertainty and insecurity that discourages both foreign and domestic investors and to reduce state revenues while adding steadily to the burdens of taxation.

When production was at its height the federal revenue from petroleum taxation was roundly $80,000,000 annually. In 1932 the total income from the same source had fallen to $6,000,000. The country's position in international trade has been greatly weakened by the decline in oil exports while all forms of industry have suffered from the scaling down of petroleum operations and the decrease in disbursements for wages, rents, materials, transportation and other items.

Mexico cannot do better than to apply the lessons of the past, to encourage investment, to protect the owners of property legitimately acquired in the enjoyment of its use, to rationalize taxation and to encourage a cooperative rather than an antagonistic attitude between employers and employees.

Obstructive Petroleum Policy Hurts Mexico

Loss of Revenue and Industrial Income Has Followed Legislative Acts and Burdensome Taxation—Natives Suffer Most from Attempted Nationalization. ***By Ing. José S. Noriega****

IN MEXICO, as in many other countries, experiments are being made in economic and social matters without knowledge of what is to be the exact result of these experiments. Somewhere between the extremes of *laissez faire* on the one hand and Communism on the other there must be a middle course that will permit the healthy growth of industry without sacrificing the interests of the state and its citizens. So far, it must be admitted, that pathway has not been found. Measures adopted to aid the national welfare have worked out to the nation's disadvantage. Laws have produced an effect contrary to that intended. We have been marching in the dark along an unknown road. It seems worth while to examine the situation dispassionately with the thought that past experience may aid in charting a sound course for the future.

In dealing with the problems of the petroleum industry the ideas, interests and opinions that have prevailed show a similarity to those which have shaped happenings in Spain where a state monopoly has been organized, in France and Italy where nationalistic policies have resulted in setting up a partial state control, and in Argentina where a powerful company has been established with state support. Certain reflections of the New Deal appear in the policies of the government which is encouraging unit operation and is thinking about fixing the price of gasoline.

In the nations referred to, however, basic conditions are altogether different from those prevailing in Mexico. The European countries cited are not producers of petroleum or at best produce in very small quantities. In the United States producing companies are predominantly national while here they are mainly of foreign ownership. Argentina somewhat resembles our country and we are pleased to call the great Republic of the Plata sister. But Argentina is free from the problems of race and caste that trouble Mexico. Its land problems are not so serious and it has been able to advance more rapidly along the road of economic independence.

Early Period of Rapid Progress

THIRTY years ago Mexico was still a typically colonial country and was under the necessity of developing its great natural resources. The government of Porfirio Diaz gave facilities to foreign capitalists and adventurers who were willing to take the risks involved in trying to develop new sources of production. Some of these enterprises were failures; others were successful.

Petroleum was discovered in the Isthmus of Tehuantepec and in the Huasteca District. This evoked immense praise for the policy of Diaz who had brought forth a new fountain of life, of work and of income. During the second decade of the present century this policy of the old dictator was bearing full fruit. Petroleum was being obtained in Panuco and in the famous "gold belt" in quantities never before exceeded and hardly ever equalled. The great world war gave to petroleum a decisive importance. Exploration and exploitation were feverishly carried on in spite of our great revolution which shook the country's institutions to their very foundations, destroying some fortunes, originating others and changing the orientation of the government in political, social and economic matters.

Up to that time the exploitation of petroleum deposits had been carried on in accordance with the mineral laws of 1884, 1892 and 1909. The first of these declared: "Petroleum and gaseous deposits are the exclusive property of the owner of the soil who by virtue of this right may exploit and enjoy them without necessity of declaration or of special adjudication." The law of 1892 permitted the owner of the soil "to freely exploit without necessity of a special concession in any case . . . minerals, combustibles, oils and mineral waters." The law of 1909 again declared: "(I) The formations or deposits of minerals, combustibles in all their forms and varieties, and (II), the formations or deposits of bituminous material, are the exclusive property of the owner of the soil." But the revolutionaries viewed with disfavor the exploitation of petroleum and the great profits attributed to the foreign-owned enterprises. They saw only the bad side of the Porfirian policy and believed that it would be a relatively simple matter to keep the control and profits of petroleum exploitation within the country.

These ideas crystallized in the constitution of 1917 which undertook to modify the law of property both in regard to soil and subsoil. In accordance with the much discussed Article 27 "the direct control of all minerals . . . petroleum and all solid, liquid or gaseous hydrocarbons is vested in the nation." The same article stipulated that "only Mexicans . . . and Mexican companies have the right to acquire concessions for the exploitation of mines, water or combustible minerals in the Mexican Republic."

It is evident that the desire was to prevent the enormous, recently discovered riches from passing into the hands of foreigners and from being rapidly dissipated. The object contemplated could not be more reasonable or patriotic but what have been the consequences? Here is one of the most conspicuous examples of a contrast between the purposes of the legislators and the results obtained. It clearly shows the futility of measures of this kind which do not take due account of the economic conditions involved.

For a time the petroleum enterprises, although protesting the new regulation, practically disregarded it. The civil war was continuing and the code could be ignored by the triumphant faction. It therefore did not come into effect and presently the petroleum companies succeeded in obtaining an interpretation of the situation which at least permitted them to continue to live. Article 27 was accepted as having no "retroactive effect", that is to say in those cases where "positive acts toward domination of the

* Sr. Noriega, author of the accompanying article, was chief of the Petroleum Bureau of the Mexican Government from 1932 to January 1935. He has devoted deep and thorough study to Mexico's petroleum industry, policy and problems and has in preparation at the present time a book dealing with the entire subject.

Cia. Mexicana Aerofoto

View of the Minatitlán Refinery of the Compañía Mexicana de Petróleo "El Aguila", S.A., situated on the banks of the Uspanapa River, 22 miles upstream from the Gulf of Mexico.

subsoil" had been carried out the rights acquired were respected.

The concept of "nationalization" was applicable only where there had been neither exploitation nor exploration nor expressed intention of the owners of the land to take possession of the subsoil. Under these circumstances exploration and exploitation were permitted under conditions imposed by the government and under the supervision and direct control of the government itself. Out of this interpretation there arose a so-called "confirmatory concession" covering lands explored previous to the constitution and "ordinary concessions" covering the areas which were applied for in accordance with the new law.

Decline of Production

BUT THIS interpretation did not become fixed in laws and regulations until 1925 and the interval was one of great insecurity and indecision. Exploitation was carried out under provisional permits according to decisions of President Carranza in January of 1920. For some time exploitation continued intensively under this stimulant but the work of exploration was suspended and no new fields were discovered to take the place of those which were being exhausted. In 1921 production reached its maximum, being 193,397,587 bbl. or 25.3 percent of the world production. After that year the production curve fell rapidly and steadily until 1931 in which year it was 33,038,853 bbl., scarcely 2.4 percent of the world production. From the second place which Mexico had attained as a producer of petroleum the country came to be seventh after a fall that was as spectacular as the previous ascent. In 1932 the downward movement was checked and there began a slow recovery of the industry. Exploration and drilling increased and production, in 1934, amounted to 38,167,022 bbl.

It has been said that the decrease of production was due to external forces and certain skillful arguments have been advanced to support this assertion. Undoubtedly the general fall of prices had some influence, but only a little consideration is needed to overthrow the thesis of external responsibility. Why have these external causes not affected other nations? Why was it that in Mexico production decreased in such a striking manner while the rest of the world was doubling its production?

There are only two causes, both internal, which explain this phenomenon. The first was the gradual exhaustion of the "gold belt" which was not replaced by new producing fields; the second was the indisposition of the companies to explore for new pools under the conditions imposed. Among the factors which made capital feel insecure were radical nationalistic legislation, political disturbances, labor agitation, exaggerated and inconsistent taxation and, principally, uncertainty regarding the future. Venezuela, Colombia, Peru and other countries offered better fields of action and the companies transferred their main operations to these countries. Their gain was Mexico's loss.

In the years of its prosperity the petroleum industry distributed large sums of money among the employes and workmen who served the companies, the land owners, the suppliers of equipment, the transportation lines and many others. The national treasury collected more than $80,000,000 solely from the tax on production and exportation. In 1931 these taxes had decreased to $6,400,017 (Mexican money). This made it necessary to burden other industries with a sum approximately equal to the decrease in revenue from the petroleum taxes, which meant a heavy load for those groups of taxpayers who were least able to pay.

System Hits Mexicans Hardest

IN ANOTHER sense the nationalization aimed at by the new policy resulted in flat failure. Exploitation remains in the hands of outside capitalists. The percentage of national enterprises, always small, has been reduced practically to zero. In some directions however, recent policy has achieved results.

Cia. Mexican Aerofoto

A scene of desolation. Abandoned terminals and tank farms at the mouth of the Tuxpam River. Formerly there were no less than nine sea-loading terminals along the Gulf Coast from Tuxpam to Tampico, now abandoned.

The training of petroleum experts has been encouraged; the companies have been required to give preference to Mexican experts rather than to foreigners. Through the increase of wages and imposition of absentee taxes it was sought to keep the returns from petroleum enterprises in the country so far as possible. Finally there was organized a semi-official corporation for regulating and supporting the industry, the object being to prevent abuses by the operating companies, to avoid excessive prices and to exploit national petroleum reserves in a manner most suitable to the interests of the country. As a complementary measure great stretches of territory along the coast and along the frontiers were incorporated in the national petroleum reserves, probably including about 90 percent of the possible petroleum fields still remaining free.

The execution of this program necessarily had to be slow. It hardly got started when there was a change of administration which, without fundamentally changing the situation, introduced certain new factors.

Assault on Titles Encouraged

As previously stated the petroleum law and regulations formulated about ten years ago established the conditions under which confirmatory and ordinary titles carrying the right for exploitation and exploration of petroleum would be issued. In those concessions covered by confirmatory titles, exploitation could be carried on with greater liberty and security than in the others because the liberal laws that antedated the constitution were held still to remain in effect. In the concessions covered by ordinary titles more exacting requirements are imposed. Rights to "exploit" do not always carry the right to "explore" and this requires further action. Under these conditions the "positive acts" of previous operations antedating the constitution assume great importance because upon these there may be based a granting of the coveted confirmatory titles. The efforts of the companies and individuals interested in exploiting petroleum therefore became concentrated on the demonstration of these "positive acts".

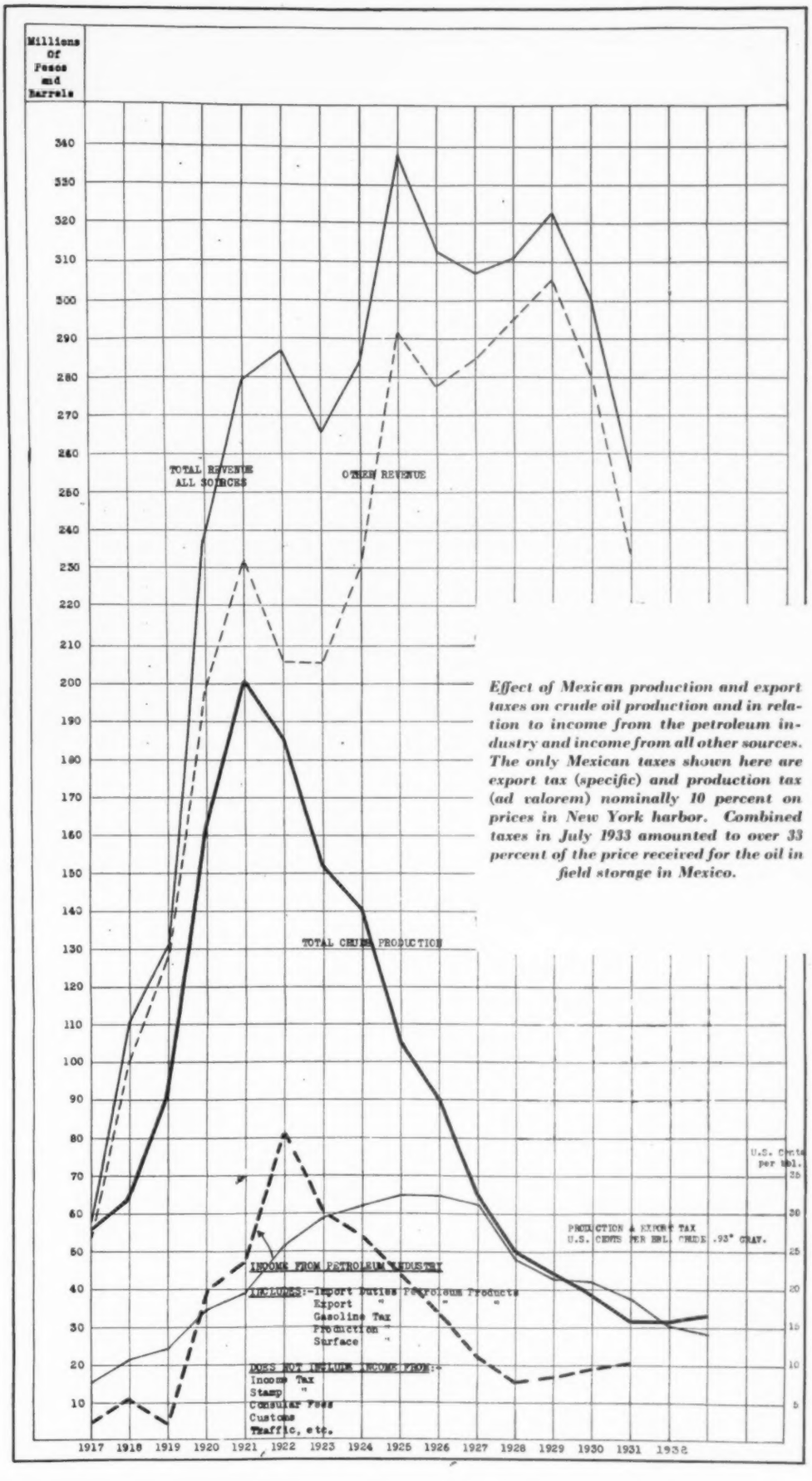
It seems, however, that the Mexican executive power is not disposed to accept the thesis that the constitution has no retroactive effect as regards the rights in the subsoil. The fact is that as time passed the documents offering proof of the "positive act" have been more and more subject to a severe and rigid examination. It is required that the "positive act" must have been executed by the proprietor of the land. At first sight this appears to be simple but very frequently in Mexico titles to property are subject to doubts and litigation. After some time it was demanded that in addition to demonstrating the "positive act" and presentation of title to the land, evidence had to be submitted that the title to the land had not been called into question during the past ten years. At first it was agreed that the ten year period referred to was one ending before the date of the application or before 1928. Later the government decided that the prescribed period must be one ending before the date of the constitution of 1917. In other words the applicant had to show not only title to the property but the antecedents of the property back as far as 1907. The result was to increase the number of adverse decisions and the lamentable fact is that the majority injured by this severe requirement were Mexicans, whereas the applications of foreigners and principally those of Americans had already been acted on while the requirements were less severe.

More than 40,000 applications for con-

cessions to explore and exploit were presented before 1932. Of these 2,700 had been acted upon, resulting in confirmation of 1,600 titles and rejection of the remainder. Since that year about 40 cases have been acted on a month and all the time the requirements are becoming more severe. It can be taken for granted that no permit will be passed unless all the legal conditions have been fulfilled, but it cannot be said that only those titles have been denied that deserve to be rejected.

Since the beginning of the present year all action on titles has been suspended and uncertainty has become more intense, raising doubts even as to the validity of the titles already passed upon.

The situation of the possessors of oil titles in the "federal zones" also is disturbing. These "federal zones" are belts of land along the banks of the rivers, canyons, lakes and lagoons over which the federal government holds jurisdiction. At first it was believed that this jurisdiction did not affect the rights in subsoil and certain decisions of the authorities supported this view. Later the decisions of the authorities were reversed and the result is that the subsoil of the federal zone belongs to the nation. The matter is further complicated by the difficulty of defining these federal zones because the



Effect of Mexican production and export taxes on crude oil production and in relation to income from the petroleum industry and income from all other sources. The only Mexican taxes shown here are export tax (specific) and production tax (ad valorem) nominally 10 percent on prices in New York harbor. Combined taxes in July 1933 amounted to over 33 percent of the price received for the oil in field storage in Mexico.

banks of the streams and of the lakes are generally vague.

Favorable Factors in Situation

CERTAIN economic considerations are favorable to the petroleum industry of Mexico. On the northern frontier much money has been spent without discovering petroleum in commercial quantities. But gas has been found and discoveries in Texas at a short distance from the Rio Bravo raise hopes that oil will be encountered on the Mexican side. Recent wells drilled in Poza Rica have shown the existence of a deposit of the first rank which recalls those of the golden era. Certainly petroleum is not yet played out in Mexico. Contrary to what has recently taken place in the United States, where known reserves are being exhausted, in Mexico they are increasing. In the former country during the past four years the quantity of petroleum recovered has greatly exceeded (by more than 200,000,000 bbl. annually) the quantity of petroleum discovered in new deposits. In Mexico, the known volume of petroleum is greater than the volume that has been extracted in the same period of time. Three years ago it was calculated that the petroleum commercially obtainable from known deposits was 300,000,000 bbl. This quantity has been considerably increased by the discovery of the Poza Rica field the total potentiality of which is not known though undoubtedly it is very great. In contrast to former times, prices are now good and demand is being admirably sustained. Finally, the monetary situation is propitious; the low rate of exchange of the peso in relation to the money of the consuming countries favors exporters.

View of the City of Mexico, looking west down the Paseo de la Reforma from the Columbus Statue to the Chapultepec Palace. The sign of the "rooster" (Gallo) (Pierce Oil Company) may be seen on the first building, second block on the left.

Cia. Mexicana Aerofoto

These favorable circumstances are neutralized however, by other factors in the situation.

The contributions and taxes laid on petroleum enterprises are enormous. Not only are they subject to the ordinances of a petroleum law but also to a labor law and to the mandates of consultation boards and arbitration boards in disputes with the laborers. They pay production taxes, export taxes, absentee taxes, rents, royalties, area taxes and numerous other contributions of very diverse character. Truly they are perplexed in an atmosphere of hostility, full of obligations, subjected to the demands of officials of all classes, and not infrequently to fines. The epidemic of strikes which characterized the beginning of the present administration seriously affected the petroleum industry. In the past year (1934) the average daily production was 104,567 bbl. and this average daily production decreased in the first three months of this year to 100,833 bbl. But more serious is the uncertainty regarding the rights for exploration and exploitation of property acquired in conformity with existing laws and regulations.

Threat of Socialism

DECLARATIONS by men prominent in the present administration regarding the necessity of establishing a socialistic regime have alarmed both domestic and foreign investors. It does not appear that the actual establishment of socialism with its accompanying destruction of private property and cancellation of contracts is at all imminent. But the teaching that is being done is socialistic and the confusion is great. For this reason it can be assumed that investments in the future will be scarce unless prevailing policies are modified.

Let us look at some other aspects of the question. The semi-official enterprise is struggling with difficulties natural to the circumstances. Subscriptions by individuals have not supplied the capital required and the consequence is that official and quasi-official elements preponderate in the enterprise. If the participation of individual capital and the influence of business men had predominated the enterprise might more easily attain its object. Things being as they are the major struggle is to throw off political influence and the intrigues and obstructions of the bureaucrats.

Since the larger part of the territory in which petroleum might be found has been incorporated with the national reserves applications for concessions have practically ceased, the government limiting itself to engagements with those which can show priority. It is impossible to state what will be the result of creating the national reserves, which renders practically nugatory the law regarding the acquisition of new concessions. In view of the enormous area covered by the reserves it is practically certain that relatively only a small part will become fixed reserves for supplying future necessities. The major part of the terrain will be open to exploitation by means of contracts as soon as the regulation is announced.

"Nationalization" Fails to Help Mexicans

AS REGARDS the proposition of "effective nationalization" of the subsoil the situation is not very promising if by this is meant that the industry is to pass into the hands of Mexicans. The petroleum business requires large amounts of capital and there are very few Mexicans who can furnish this and who have experience in the organization, financing and management of large enterprises. These men do not repose confidence in the assistance of a government which rests on the support of the proletariat.

The administration has reached the conclusion that possession of concessions and the right to exploit them is the main thing with the oil men. This is a serious error. In my opinion the essential factors are as follows: The capital necessary for exploitation, an efficient organization, a knowledge of the business, energy and persistence and finally confidence that they will be protected in the use of their property and that there is hope of a profit.

In this last respect the Mexicans are in a worse situation than the foreigners. It is said that the Mexican capitalist is timid and easily frightened, that he wishes to invest only in businesses that are well known and which offer few risks. This is true, but it is the consequence of rude blows that have been sustained in our

agitated political life. The Mexican capitalist who ventures beyond the well marked lines of his past and launches into enterprises similar to those to which the foreigners commit themselves, loses his fortune in the first revolution and very often it only requires a simple change of the government to cause his investment to depreciate. Extremely severe legislation also seriously injures the small independent industrialists among whom Mexicans are included. Such measures are an annoyance to the big foreign enterprises but they kill Mexican enterprises.

Recently there was decreed a surface tax on oil properties. Each possessor of an oil title has to pay a tax proportional to the area of his claim. The object of the tax was to prevent land monopolies, to prevent large areas of land covered by confirmatory titles from lying idle indefinitely. The object was also to decrease the difference between the values and importance of a confirmatory title and an ordinary title. It is possible that the decree has some advantages but we wish merely to call attention to one inevitable consequence. Large areas already covered by concessions will be abandoned and will revert to the reservations of a government already overloaded with land. The big enterprises will be able to bear this new charge, particularly where exploitation is going on, but where there is not yet any production it is impossible to preserve the concession. This will be the case with Mexicans, the greater majority of whom have lost their titles, the result being a still greater disproportion between Mexican and foreign properties. After the present depression had passed these Mexicans might have been able to develop their properties but now they will have no such opportunities. These Mexican properties were offered in the first place to the big foreign enterprises and without doubt in certain cases they were acquired at low prices, because the Mexicans were not in a position to haggle or to hope. Where they were not able to transfer their permits they abandoned them, thus losing all that they spent in the effort to obtain the titles and in some cases all that they had spent on exploration.

We are at the parting of the ways. Does the government wish the petroleum industry to realize its full possibilities as an instrument of national prosperity or does it want to diminish the activities and importance of the industry? If the latter be the aim it is necessary only to continue strikes that are invariably followed by decisions adverse to the employers, to deny applications for exploring and exploiting, to subject titles already acted upon to reconsideration, to continue the teaching that promotes the class struggle and the appropriation or destruction of property. We will then have a decrease in the activity of the industry similar to that of the years 1921 to 1931. The powerful foreign companies will seek fields of operations outside of Mexico; the national enterprises, not able to extend the radius of their action beyond the country, will perish.

Cia. Mexicana Aerofoto

View of the Tonalá Field on the Isthmus of Tehuantepec. Oil is transported by pipe-line over a jungle country to tide-water terminal at Nanchital on the banks of the Coatzacoalcos River, 22 miles away.

On the other hand if the government encourages investors by measures which will give security and confidence; if it will permit the workmen and the employers to know what paths they can tread; then this industry and others will flourish anew. Beyond our frontiers there exist enormous amounts of capital in a state of inactivity which waits the opportunity to become active and to produce. According to the latest financial information, the deposits and the reserves accumulated in American banks are the greatest that have ever been known in the history of the country, much exceeding those that existed in 1929. A part of this capital would embrace the opportunity which this country presents, and would come to develop some industries and give new life to others. Mexican capital too would cease to be invested solely in urban construction and in mortgage loans, and would venture, with greater and greater resolution, into other spheres.

Unquestionably it is desirable to avoid extremes. It would be relatively easy to create a situation of security and confidence without overloading capital with advantages, a situation in which the workers and the employers could get together amicably. During the extremely agitated months of the past year such a situation would have been better for the industrialists, the public and the workers. Many of the latter were dragged into strikes under intimidation by their leaders. What they want is regular work, high wages and opportunity for improvement. These can be obtained only in an atmosphere of serenity.

It is evident that the exploitation of certain sources of national wealth is being neglected, with prejudice to the whole country, due to the lack of guarantees to the investor. For example, it would be possible to supply the Federal District with natural gas by means of a pipe line installation which would transport this valuable fuel from the oil fields. This would give incalculable advantages to the inhabitants of the capital and lead to a social and economic transformation of the first importance. Under present conditions, however, it will be difficult to find anybody to launch such an enterprise, and the gas continues to burn in the oil fields.

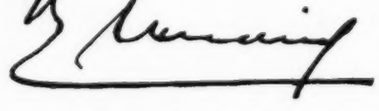
Which road will the Mexican Government follow? I am inclined to believe that conditions will change for the better. Without abandoning the victories won by the workers, and without relinquishing the aspirations of nationalism, it is reasonable to hope that there will come a situation of greater security for capital and of greater social justice.

Diesel Vehicle's Influence on Refining

Gasoline Cracking May Have to Be Reduced In Order to Provide Sufficient Light Fueloil, Unless the Number of Private Motorcars Increases and Maintains Refinery Balance. By T. Orchard Lisle

WITHIN the next five years the major countries of the world can reckon on having over half-a-million oil-engined commercial vehicles running on their roads—or, one-eighth of the total passenger and goods vehicles in service—unless too severe taxation puts a definite halt to the present rapid development. As a matter of fact, if the output of Diesel vehicles in the United States makes the same proportionate headway in ratio to gasoline vehicles as in Europe, then the number in service by 1940 will be very much greater, and must have a considerable effect upon refinery production. One can take it for granted that in ten years time over ninety percent of all buses and lorries will be oil-engined—perhaps ninety-nine percent. Already in four major countries,—Great Britain, Germany, Italy and France, which at present form the biggest markets for gasoline outside of America, transport companies have virtually abandoned the use of motor spirit for all new buses and heavy lorries, and have turned to the heavier fuel. Then again, the same type of high-speed Diesel engine is being used in increasing numbers for driving tractors; fire-engines; garbage wagons; watercarts; portable compressors; welders and pumping sets, as well as for rail-cars and locomotives. In Germany alone there were about 30,000 Diesel tractors, mostly on farms, at the end of 1934. Aeroplanes, too, may turn extensively to Diesel drive before long. The remarkable point about the development is that while many engineering experiments have been going on for twenty years, it is only during the past three years that the mechanical equal of the gasoline engine has been reached. Only for the same period has the transportation industry widely accepted the change; consequently the recent ratio of growth has been extraordinary. Progress with metallurgy, and with fuel-pump and combustion-chamber design has made the Diesel suddenly available to transport interests, and the obvious economies brought as rapid a response in demand. Bosch and Ricardo were two of the outstanding factors responsible for the engineering advance.

"FROM the national point of view the rapid development of the Diesel-engined vehicle is all to the good, because it means a reduction in transport costs which is a fact of the greatest importance for industry generally. It is up to industry to see that this gain is not taken from it by excessive taxation or the plea of protection for vested interests. All over the world the Diesel vehicle is making rapid progress, and in Great Britain we hear of large manufacturers whose output of heavy-oil engines for transport purposes has actually outstripped that of petrol-engined vehicles."



—Sir Henri W. A. Deterding.

The first serious blow struck at this budding infant was made by the British government in imposing as of August next a tax of 8d. (16 cents) per Imperial gallon on all oil used as fuel for road transportation in place of the penny tax levied a year ago. As yet, manufacturers and owners of Diesel-engined vehicles have not recovered from the overpowering shock given when Chancellor-of-the-Exchequer Neville Chamberlain recently announced this part of his Budget, and time alone will show just how big an obstacle now confronts them. Happily, the Diesel engine offers so many operating advantages over its gasoline sister that even this terrific tax burden will not be sufficient to cause a complete flow back to the lighter fuel, especially as the new road-tax on Diesel vehicles will diminish the effect of the fuel tax considerably.

Mr. Chamberlain must have been aware of this as he referred to the lower consumption of the oil engine in his Budget speech, and mentioned that actually he should have raised the tax to 1s. 2d. per gal. because of the greater mileage of the Diesel vehicle. Nevertheless, such a drastic tax at so early a stage in the development, when engine manufacturers cannot have wiped off the huge costs of development, must have a serious and retarding effect. Minimising the home market demand will undoubtedly affect their export trade, as it keeps up the manufacturing costs. It is the only item in the Budget that has since been subjected to strong criticism, with the possible exception of his raid on the Road Fund. The money available in the Fund might well have been utilised to lower the general level of motor taxation. Pressure now being brought to bear may cause the Chancellor to modify, temporarily, his tax proposal.

It might well be said that British Diesel manufacturers and transport companies now have to pay the price of tax exemption given to motor spirit produced from coal by hydrogenation and low-temperature carbonization; because the government naturally must find ways and means of producing revenue to offset what it loses through this big subsidy.

In any event, the British government is evidently alive to the important change taking place, and is determined not to lose any revenue as the result thereof. But, in the opinion of interests involved, action has been taken far too suddenly and too drastically; because, as yet, the national sale of Diesel oil for vehicles has only reached 750,000 bbl. per annum. The

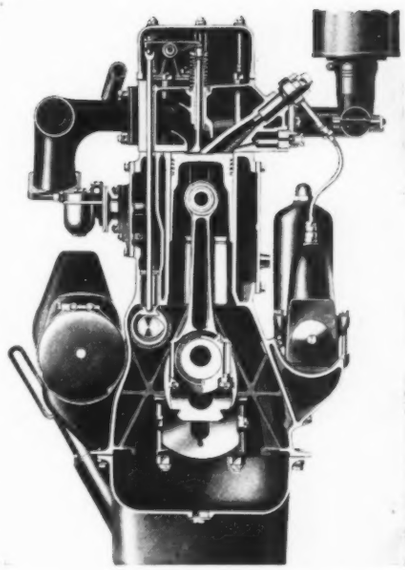
tax will not add much to the government's revenue for a few years but may seriously harm a young industry before it can properly stand on its feet. It would have been more fair and more remunerative to have increased the tax yearly as the number of vehicles grew, on the grounds that had the gasoline motor been similarly super-taxed in its early days there would still be an enormous amount of horse-drawn private and commercial vehicles on the road today. This taxation must not be regarded as purely a local matter for its effect will be closely watched by other governments with a view to similar action.

At the end of 1934 there was a grand total of 2,447,101 mechanically-propelled vehicles on British roads, of which 548,461 were motor-cycles and 11,516 electric tramcars, 84,167 taxicabs, 31,155 government vehicles, fire-engines, ambulances, etc., and 1,308,425 private motorcars. The balance of 464,413 are some form of commercial vehicle, and these with the taxicabs consume over 70 percent of the 30,000,000 bbl. of gasoline marketed in Great Britain annually. Ireland is not included in these figures. Obviously the Treasury saw nearly a half-million commercial vehicles turning to Diesel with a possible terrific drop in tax revenue. Official figures on September 30, 1934 indicated that there were 2,397 buses, 13 agricultural vans and 4,304 lorries, etc. in Great Britain.

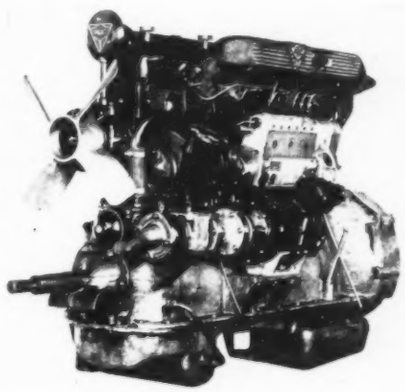
From non-official figures it seems that the increase in Diesel buses was in somewhat greater proportion than lorries but there was no bus type segregation in the 1933 official figures. Nor are the number of Diesels in government vehicles given for either year. In December, 1931, there were less than 500 oil-engined buses and lorries.

During the twelve months ending September, 1934, 72,637 internal-combustion engined buses and lorries were placed upon the roads of Great Britain (not counting 3,492 government vehicles). Of the former, 2,312 were Diesel driven. When it is considered that the output of the Associated Equipment Company, which is one of the largest firms of commercial vehicle makers in the country today, is 75 percent Diesel it is not difficult to realise that it is only a question of a few years before the figures for gasoline and Diesel vehicles will be completely reversed. For instance, the Scottish Motor Traction Company has 1,228 oil-engined buses in service and more on order. The City of Birmingham recently ordered 135 buses of this type, and many corporations are converting existing petrol buses.

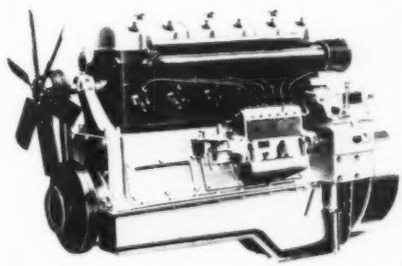
Although William Forbes, manager of the City of Cardiff's transportation department believes that the feeling of uncertainty as to the future will have a harmful effect on Diesel vehicle advancement, he figures that there will still be a saving for the 60 Diesel buses of the corporation over petrol buses of 0.87 pence per mile, or £10,875 per year for the fleet. This, with oil at 11-⅜th pence and petrol at 1s/- per Imperial gallon, including 8d. tax in each case. The increased duty will amount to seven-tenths penny per mile, or £116.13 per bus per year. Of its fleet, 36 vehicles have been converted to Diesel from petrol. Each bus runs about 250,000 miles during its five-year life, and uses about one gallon per ten miles. Fuel costs work out at 1.99d. per mile and 1.12d. per mile, respectively, for oil and petrol.



M.A.N. 90 h.p. 6 cylinder Diesel motor for bus or truck power as used in Germany.



Latest A.E.C. Diesel engine used with London buses.



M.W.M. 90 h.p. Diesel for road tank truck in Germany.

What effect is this going to have upon refining, and especially on cracking? The increase in demand for this fuel in Great Britain in 1934 was 135 percent over 1933. While the total as yet is comparatively insignificant, it will have reached importance by 1940.

First, let us see what is going on in Germany, an indication of which was given in the discussion of commercial vehicles at the recent Berlin Motor Show, published in the April issue of WORLD PETROLEUM. In that country the progress of the Diesel engine is being encouraged by Fuehrer Hitler, and not hampered by such a high fuel-tax as will shortly come into force in Great Britain. Also, in Italy and France the Diesel is steadily gaining in numbers, and nearly equals the former country, which had over 12,000 Diesel vehicles and 30,000 Diesel tractors in operation a year ago.

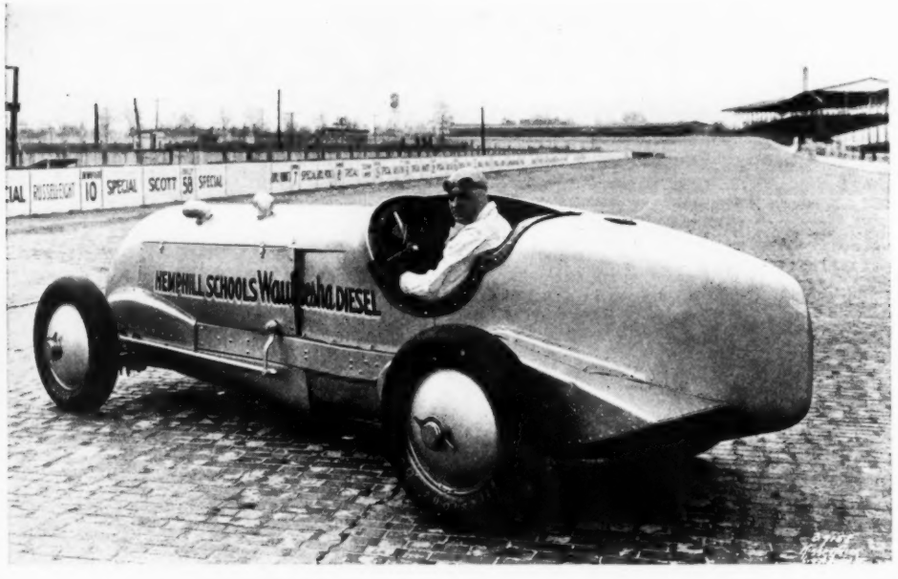
The total petroleum-product consumption in Germany in 1934 was 2,501,000 metric tons, of which no less than 710,000 tons was gasoil (Diesel fuel). The latter represents an increase of 22 percent over 1933, and is mainly due to the larger demands for Diesel vehicles. As it happens the demand for gasoline for private cars also increased to a somewhat similar extent due to the opening of the new motor-roads, so there apparently is nothing to disturb refinery output so far as the economic ratio of gasoline and Diesel oil is concerned. But, let us look a little more closely into the statistical position! It indicates a different status.

Imports of gasoline and gasoil were 1,050,000 tons and 60,000 tons, respectively, plus 40,000 tons of benzole, while 741,000 tons of motor spirit, or 39 percent, and 110,000 tons of gasoil were produced from domestic crude and coal. The alcohol consumption by vehicles was 171,000 tons,—presumably blended.

Germany is encouraging hydrogenation from coal with a high preferential tax treatment. Production of motor spirit

by this method is now at the rate of 300,000 tons annually; but Diesel fuel by hydrogenation is practically out of the question. Low temperature carbonisation of coal also is being made obligatory, and it is possible that several hundred thousand tons of motor spirit will be produced in this manner.

Because the building of gasoline-engined heavy commercial vehicles has virtually ceased in Germany, and as many existing lorries and buses are being reengined with Diesels, in a few years the only gasoline conveyances on the roads will be private cars. This means that importing companies will have to supply increasingly larger quantities of gasoil, or light fueloil, and smaller quantities of motorspirit, which inevitably must have an effect on refinery product output ratio to the point that less fueloil will be cracked for gasoline, although viscosity breakers may be used for cracking fuel oil to produce the lighter fuel needed by high-speed Diesels. At present Germany has over 163,000 commercial vehicles, of which 69,000 are over 2½ tons capacity. About 17½ percent of the heavier class are Diesel powered as well as some of the lighter vehicles.



Diesel racing car on the Indianapolis track in the United States.

New Registrations of Light Vehicles in Germany

Year	Number of Vehicles Newly Registered	Percentage Diesel Powered
1932	3,230	45
1933	6,010	65
1934 (1st 9 months)	8,340	75

This clearly shows the rapid rate of increase, and it can be taken as fairly certain that figures for 1935 will show at least 99 percent Diesel in the case of new registrations.

The consumption of the average truck and bus in Germany is about 10 tons per annum, while that of tractors is about three tons. Hence, in 1934 the consumption was approximately 210,000 tons, and will be well over 300,000 tons this year, and probably will rise in about this proportion each year until about 750,000–850,000 tons is reached.

The price of Diesel oil delivered in bulk to transport companies in Germany is 11.50 RM per 100 kilos, compared with 43 RM for the average gasoline-benzole mixture used by lorries. This means that per 100 kilometres of running the fuel-costs work out at 3.90 RM and 18 RM respectively. Hence, the Diesel vehicle has a 78.5 percent advantage. Other operating costs, including repairs, are about the same as units with gasoline engines. First costs of the oil-engined lorry are a little higher.

As there is only about one-cent difference per gallon in Gulf prices for the two fuels, it stands to reason that the price of gasoil must increase. In Great Britain, Diesel oil has been selling in bulk at 4½ pence (9 cents) per Imperial gallon including one-penny tax, whereas gasoline in bulk before the recent rise was selling at 10½ to 11½ pence including eight pence (16 cents) tax. No oil company can be proud of such unremunerative prices in a market where the consumption of both fuels is rapidly increasing. The new tax on Diesel oil will bring up the price of Diesel oil to 11½ pence per gallon, and possibly will make it extremely difficult for marketers to obtain a better price. Had Diesel oil been selling at a higher figure it is doubtful if the government would have made such a drastic increase in the tax for a year or two; but rather in a series of increases.

What is the attitude of the Royal Dutch-Shell group to the Diesel vehicle movement? Sir Henri W. A. Deterding, director-general, has very kindly made a few comments to WORLD PETROLEUM. His remarks were actually penned before the high tax was announced, so what he says on the subject of taxation is of particular interest.

"As to the probable effect of the growing importance of the high-speed Diesel engine on petroleum refining policy, I would inform you that our attitude to the subject during the last five years has been in a sense one of 'benevolent neutrality', that is to say, we have endeavoured to keep abreast of all developments of the high-speed compression-ignition engine and, whenever it was to the advantage of consumers to use Diesel engines rather than petrol engines, we have not been slow in pointing this out.

"The remarkable advance during the last year or two in the popularity of the high-speed Diesel engine for all types of heavy vehicle has been due to its great efficiency and low fuel-consumption. The slightly higher initial cost of the Diesel engine is by comparison a trivial matter.

"Again, the lower price of the fuel which it uses is only a secondary consideration. Incidentally, this latter advantage is almost entirely an artificial one, since it is due to a great extent to the inordinately high taxes levied on petrol by short-sighted governments in the majority of countries today.

"All over the world the Diesel-engined vehicle is making rapid progress. In this country we hear of large manufacturers whose output of heavy-oil engines for transport purposes has actually outstripped that of petrol-engined vehicles. A typical example is the announcement recently made by the Associated Equipment Company to the effect that 75 percent of their current production of passenger vehicles is now fitted with Diesel engines.

"We get similar reports from other countries. For example, at the Commercial Motor Show in Berlin last year Diesel-vehicles appeared to have almost completely ousted petrol vehicles, and so it is there this year.

"From the national point of view, this development is all to the good because it means a reduction in transport costs, which is a fact of the greatest importance for industry generally. It is up to British industry to see that this gain is not taken from it by excessive taxation or the plea of protecting vested interests. In this country, the

Diesel-engined lorry is subjected to a higher rate of tax than a petrol vehicle of the same unladen weight. Since a Diesel-engined vehicle as well as being a little more expensive is, necessarily, somewhat heavier than a petrol-engined vehicle of the same carrying capacity, the handicap so imposed is actually greater than might appear from a mere inspection of the respective scales of tax. Whilst it is perfectly fair that a heavier vehicle should pay more than a lighter one, the suggestion that it is legitimate to impose a higher tax on a new type of machine simply because it happens to be more efficient is in my opinion a most dangerous one.

"In spite of the progress of the high-speed Diesel engine, the demand for special Diesel oils has not yet reached very great dimensions but, if and when it does so, the oil companies will be in a position to supply what is wanted. Granted the continuance of a system of free and open competition, it may be confidently assumed that any adaptations in the existing methods of production, which may be needed to meet changes in the demand for oil products, will be made and that the supply will always be waiting when the demand is there."

(Signed) H. W. A. Deterding.

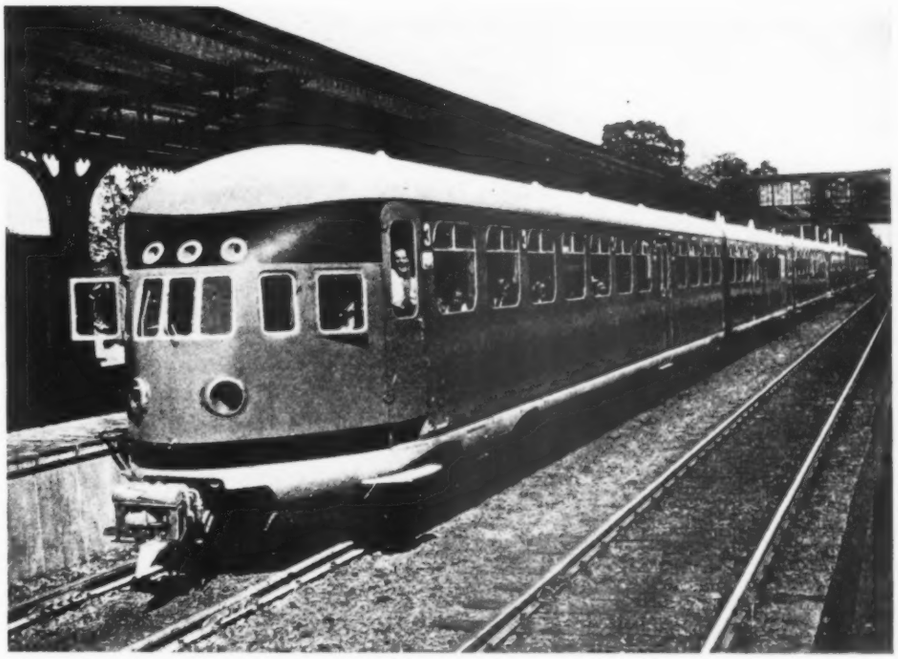
It is most interesting to record that the increase of the tax on Diesel oil was long foreseen by the London Passenger Transport Board, and that regardless of this anticipation they went ahead unswervingly with their bus Dieselisation programme because of the all-round advantages and economies secured. At the end of January, 1935, the total number of Diesel buses in the Board's London district service was 555, and since then a further large number has been ordered. But, it is doubtful if the 8d. tax was expected so soon as it means an extra cost of about £90,000 per annum on their existing Diesel buses.

Through the courtesy of A. A. M. Durrant, engineer of the bus services of the London Passenger Transport Board, it is possible to give some interesting notes on the development and experiences gained since this concern's experimental Diesel buses in 1929.

The London Transport Board only came into being a couple of years ago. It now operates every form of public passenger transportation in greater London except taxicabs. It absorbed the London General Omnibus Company, which commenced practical tests in 1929 with three Junkers opposed-piston type Diesels driving—not buses—but store lorries. A further lorry was equipped with a six-cylinder A.E.C.-Acro oil engine having the Bosch fuel pump-injection system.

Because of the encouraging results three buses were similarly equipped in January, 1931, and twelve more two months later. Minor obstacles were experienced, particularly difficulty in preventing the emission of black smoke; but the general results were satisfactory. Nevertheless, all the early buses were operated on suburban routes.

From this early experience, a new form of combustion chamber was evolved by the A.E.C. in conjunction with Mr. Ricardo, this being based on the now well-known rotational air-swirl principle. In this design the separate combustion chamber is spherical in shape and connects with the cylinder by a narrow throat. A violent swirl of air is set up at the end of the compression stroke and the fuel is injected into the spherical chamber, where rapid, controlled, combustion takes place. Service tests with one experimental engine of this type showed it to possess such marked advantages that the whole of the twelve engines then in operation were converted.



One of a number of Diesel-electric streamline trains in Holland operating at a speed of 140 km. per hour.

In October of the same year, a further twenty vehicles of the improved type were acquired. A year later a total of ninety-four A.E.C.-Ricardo engines were in service, and operations were transferred to one of the principal routes running into the City from the Hanwell garage. In December of the same year a further eleven omnibuses were equipped with a well-known example of the direct-injection principle, wherein fuel is sprayed into a compact chamber located in the top of the piston. In this way this entire garage was converted to the use of oil-engined

Latest type Diesel bus of the London Transport Board.

omnibuses, and special arrangements were made to facilitate the collection of data. By August, 1933, considerable improvement had been effected in the small mechanical details, and it had become apparent that the oil engine offered attractive advantages over the petrol engine.

By the time some 300 buses were in operation, extensive research rendered it possible to construct a much lighter oil engine.

	1934 Engine	1932 Engine
Maximum power	120 b. h. p.	130 b. h. p.
Bare weight	1,036 lb.	1,278 lb.
Bore and stroke	105 mm x 146 mm	115 mm x 142 mm
Revolutions p. m.	2,000	2,000

The question of fuel is one of great importance to both oil companies and transport operators.

"Contrary to rather exaggerated claims made in some quarters," says Mr. Durrant, "the high-speed oil engine is not yet capable of giving satisfactory service with any low grade of fuel. If, however, the necessity arose, there is no doubt that the engine manufacturers would immediately institute vigorous research into the possibilities of using a wider range of low grade fuels, and there would seem to be no fundamental reason why success should not ultimately attend such endeavor. In the first place, cleanliness is essential and an efficient filter should be installed between the tank and the engine to avoid the danger of damage caused to the pump by foreign matter. The fuel generally employed is a gasoil, and in the interests of quiet running, *it is very desirable that this shall be of a paraffinic nature.* The presence of aromatics is undesirable, as they tend to cause knocking. This ignition temperature, for the same reason, should be as low as possible; but, it has not yet proved feasible to set a standard which can be generally applied to any fuel.

"A little research has been carried out into the possibility of using dopes such as ethyl nitrate. Unlike the anti-detonants used in modern petrols, this is a pro-knock and is intended to diminish the delay which usually occurs in the early stages of combustion in the oil engine."

In service it has been found that horsepower for horsepower the consumption of the Diesel bus engine is only about 60 percent of that of the gasoline engine. At present, owners enjoy a double economy—one from the lower consumption and the other from the lower cost of fuel.

It seems possible that the Chancellor was partly influenced by the Salter Committee Report of 1932 on British road transportation. The operating costs as given in this report show that even with the price of oil doubled the Diesel vehicle is still much cheaper to run than the gasoline vehicle. The following table is the committee's estimate,—

Vehicle	Miles per gallon (Petrol)	Cost per Mile in Pence: Petrol at 1s. 2d.	Fuel Oil at 5d.	Fuel Oil at 10d.
26–32 seater bus	8	1.75	0.37	0.74
48–56 seater bus	5½	2.55	0.55	1.10
1½–2 tons goods vehicle	12	1.17	0.25	0.50
3–4 tons goods vehicle	9	1.56	0.33	0.66
8–9 tons goods vehicle	4	3.50	0.75	1.50

The above comparisons in the light of today's market conditions are definitely misleading; for bus companies secure delivery of gasoline at 10½d. to 11½d. per gallon in bulk and Diesel oil at about 4½d. including taxes. Consequently, as already stated in this article, the imposition of the new tax will mean that transport concerns will have to pay just as much for oil as for petrol.

Some observers are inclined to consider that the marketing departments of the British oil industry must shoulder a share of the blame, because they left the door wide open to this heavy taxation through letting such a big margin exist between the final prices of Diesel oil and gasoline to the consumer.

Apart from the matter of fuel taxation, recent British legislation has demanded a higher standard of maintenance in both omnibuses and goods vehicles, and again, restrictions have been placed on the number of hours worked by a driver in a given period. Whilst these new regulations are for the good of the community at large, it is clear that many operators must have been involved in a considerable additional expenditure, and the oil engine is, therefore, one means of offsetting this.

With petrol at 11d. per gallon the cost per mile will be as follows: 8 miles per gallon costs 1.38d.; 5½ miles per gallon costs 2.01d; 12 miles per gallon costs 0.92d per mile; 9 miles per gallon costs 1.23d. per mile; and 4 miles per gallon costs 2.75d. per mile.

The action of the British government in setting the tax rate at the same figure as for petrol deprives the operator of this benefit. Actually, there are several sound reasons why Diesel vehicles should receive preferential tax treatment. First, they should be encouraged because of their immunity from a serious outbreak of fire following a collision. Secondly, a matter of increasing importance, particularly in congested areas, is the almost entire freedom of the exhaust gases from poisonous carbon-monoxide where good combustion regulation is obtained. These things are for the public good. France has taken a direct opposite action to the British government by reducing the taxes on fuel used by Diesel vehicles from 59 Frs. per 100 miles to 25 Frs. so that they are now only one-third of those on gasoline.

Now that development has gone so far it will be most regrettable if the capital expenditure incurred in research work is wasted by a serious set-back to the oil engine.

▼

Soviet Refinery to be Built by U. S. Firm

A CONTRACT was signed early in June by Ivan V. Boyeff, chairman of the Board of Amtorg Trading Corp., and William C. Dickerman, chairman of Alco Products, Inc. including the largest purchase of petroleum refining equipment by the Soviet Union in several years. The 500,000 ton capacity refinery was purchased at a cost of approximately $1,200,000 for Vostokneft and will be installed at Ufa to refine crude from Sterlitamak field.

Alco Products also has contracts for a complete specialty plant on Elesmere Canal in England for Anglo-American Oil Co.; a 4,000 bbl. crude distillation plant for Penzoil Co. at Oil City, Pa.; another contract to erect a crude distillation plant in the southwest United States; and, it is reported a plant for Standard of California in British Columbia.

1,000 Percent Increase in Valve Pressures

Development of Manganese-Molybdenum Steel for Oil Industry Valves and Fittings Has Brought About Remarkable Increases in Tensile Strength, Yield Point, Ductility.

By A. C. Gregg

Kerotest Manufacturing Co.

THE material and workmanship used in the manufacture of valves and fittings for the oil industry have been steadily and continuously improved during the past fifteen to twenty years. The development work underlying this improvement was undertaken by progressive valve manufacturers in response to the increasingly exacting demands made by the users of valves, which in turn was a result of the growing severity of the service. As deeper and still deeper wells have been drilled and working pressures have been constantly getting higher, there has been a necessary evolution to the material used for valves from cast iron to semi-steel—from semi-steel to cast steel, and finally from cast steel to alloy steel.

About fifteen years ago the Kerotest Manufacturing Company of Pittsburgh made the first large cast steel valve for oil field service. Prior to that time cast iron and semi-steel were the materials commonly used. This valve was of 12 in. size, weighed 2,400 lbs. and was tested at 4,000 lbs. pressure per square inch. It replaced a 12 in. cast iron valve which weighed 8,000 lbs. and which was subjected to a test pressure of only 2,500 lbs. per square inch. During the early days of the steel valve, the only specification was that it be made of cast steel. This is interesting when compared with the intricate and exacting requirements for steel valves of the present day.

The replacement of cast iron by cast steel was a logical development, because of the possibility offered by steel for a great reduction in weight accompanied by increased strength and especially by increased toughness and resistance to shock. Other, and by no means insignificant, factors were the increased safety to workmen afforded by the use of steel, and the fact that in case of fire the danger of cracked and ruined equipment was materially minimized.

The ductility of cast iron and of its near relative semi-steel is almost nil. The strength and shock resistance of both metals are very low. Ordinary cast steel, even in the "as-cast" condition, has three to four times the tensile strength of cast iron, and twice that of the semi-steel of 15 years ago. It has 15 to 20 times the shock resistance of either metal.

The physical properties and structures of .30 carbon cast steel are shown in Figure 1 in four typical conditions. A—"as-cast"; B—Fully Annealed; C—Normalized and Tempered; and D—Quenched and Tempered.

A study of the figures for physical properties shows the following comparisons of interest.

Tensile Strength:

The "as-cast" bar has a breaking strength of 75,000 lbs. per square inch which is changed very little by either annealing or normalizing. The quenched and tempered bar shows a tensile strength of 84,750 lbs. per square inch which is 13 percent higher than the "as-cast" specimen.

Yield Point:

The yield point of the "as-cast" bar is 38,800 lbs. per square inch. Both annealing and normalizing treatments increase this to approximately 43,500 lbs. per square inch, which is a 12 percent improvement. The quenching and tempering treatment raises yield point to 60,850 lbs. which is 57 percent better than the "as-cast" condition.

Elongation:

The annealed and the quenched and tempered bars show an improvement over the "as-cast" condition of about 18 percent. The normalized bar is about 31 percent higher than the "as-cast."

Reduction of Area:

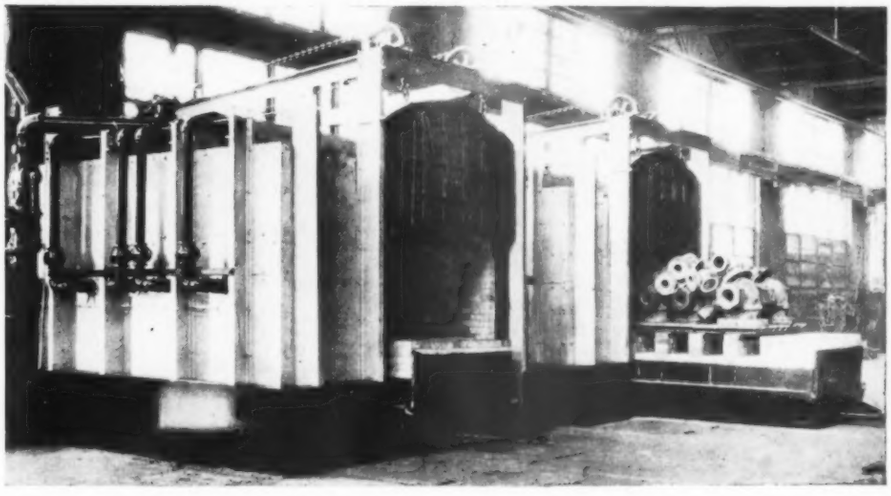
This property is important as an indication of ductility. The annealed bar shows an improvement over the "as-cast" of 75 percent. Both the normalized and the quenched and tempered bars have figures 134 percent higher than the "as-cast" and 30 percent higher than the annealed specimen.

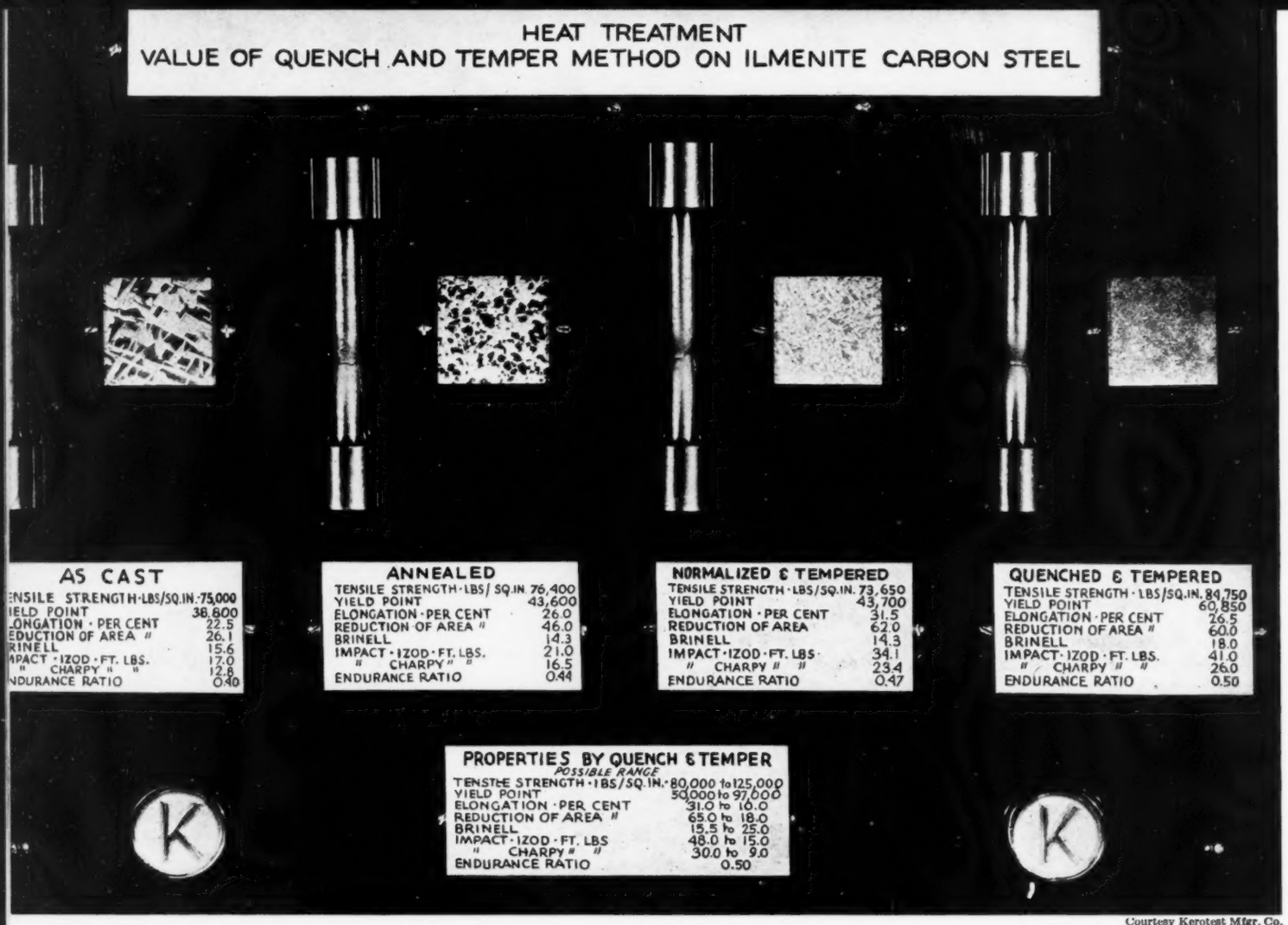
Impact Test:

Resistance to shock is determined by two well-known impact tests—Izod and Charpy. Both tests give the same information. These dynamic shock tests are probably the most interesting of all the tests made. For the "as-cast" bar the Izod test shows a resistance to shock of 17 foot-pounds. The annealed bar shows 21 foot-pounds which is an improvement of 23.5 percent. The normalized and tempered result is 34.1 foot-pounds or 100 percent better than the "as-cast" while the quenched and tempered bar shows a figure of 41 foot-pounds or 141 percent better. The quenched and tempered bar is 95 percent more shock resistant than the annealed.

Resistance to shock (or toughness) and high tensile strength are properties opposed to one another. The metallurgist is forever seeking the steel and the treatment which will produce the highest possible strength with the highest possible toughness. In selecting the steel for any given application, it is necessary to select the best possible compromise between toughness and strength to meet the particular application in question. If toughness be more important than strength or hardness, the treatment must be such as to produce a low Brinell figure. If hardness be the more important requirement, the accompanying lack of toughness can be disregarded, the steel should be treated

Figure 3




HEAT TREATMENT
VALUE OF QUENCH AND TEMPER METHOD ON ILMENITE CARBON STEEL
AS CAST
ENSILE STRENGTH·LBS/SQ.IN. 75,000
IELD POINT 38,600
ONGATION · PER CENT 22.5
EDUCTION OF AREA " 26.1
RINELL 15.6
MPACT · IZOD · FT. LBS. 17.0
" CHARPY " " 12.8
NDURANCE RATIO 0.40
ANNEALED
TENSILE STRENGTH·LBS/ SQ.IN. 76,400
YIELD POINT 43,600
ELONGATION · PER CENT 26.0
REDUCTION OF AREA " 46.0
BRINELL 14.3
IMPACT · IZOD · FT. LBS. 21.0
" CHARPY " " 16.5
ENDURANCE RATIO 0.44
NORMALIZED & TEMPERED
TENSILE STRENGTH · LBS/SQ.IN. 73,650
YIELD POINT 43,700
ELONGATION · PER CENT 31.5
REDUCTION OF AREA 62.0
BRINELL 14.3
IMPACT · IZOD · FT. LBS · 34.1
" CHARPY " " 23.4
ENDURANCE RATIO 0.47
QUENCHED & TEMPERED
TENSILE STRENGTH · LBS/SQ.IN. 84,750
YIELD POINT 60,850
ELONGATION · PER CENT 26.5
REDUCTION OF AREA " 60.0
BRINELL 18.0
IMPACT · IZOD · FT. LBS. 41.0
" CHARPY " " 26.0
ENDURANCE RATIO 0.50
PROPERTIES BY QUENCH & TEMPER
POSSIBLE RANGE
TENSILE STRENGTH · LBS/SQ.IN. 80,000 to 125,000
YIELD POINT 50,000 to 97,000
ELONGATION · PER CENT 31.0 to 16.0
REDUCTION OF AREA " 65.0 to 18.0
BRINELL 15.5 to 25.0
IMPACT · IZOD · FT. LBS 48.0 to 15.0
" CHARPY " " 30.0 to 9.0
ENDURANCE RATIO 0.50
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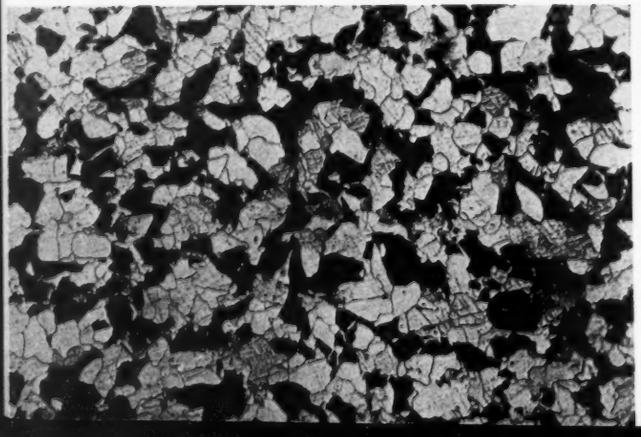
Courtesy Kerotest Mfgr. Co.

Figure 1

Figure 4

Figure 5



to produce a Brinell figure as high as possible.

Valve steel must have very high strength to withstand stretch, but it is also absolutely essential that it be tough and shock resistant to meet the sudden strains put upon it in service. The practical limits for hardness in a carbon steel valve lie between 150 and 180 on the Brinell scale. This represents a tensile strength between 75,000 and 90,000 lbs. per square inch (or say a mean of 82,000 to 84,000 lbs. per square inch). With this tensile strength, carbon steel properly heat treated will show an Izod figure of 40 to 42 foot-pounds.

It is easy to understand why cast steel replaced cast iron as the material used for valves, but carbon cast steel with all its excellent combinations of properties does not satisfy all of the present day demands of valve users.

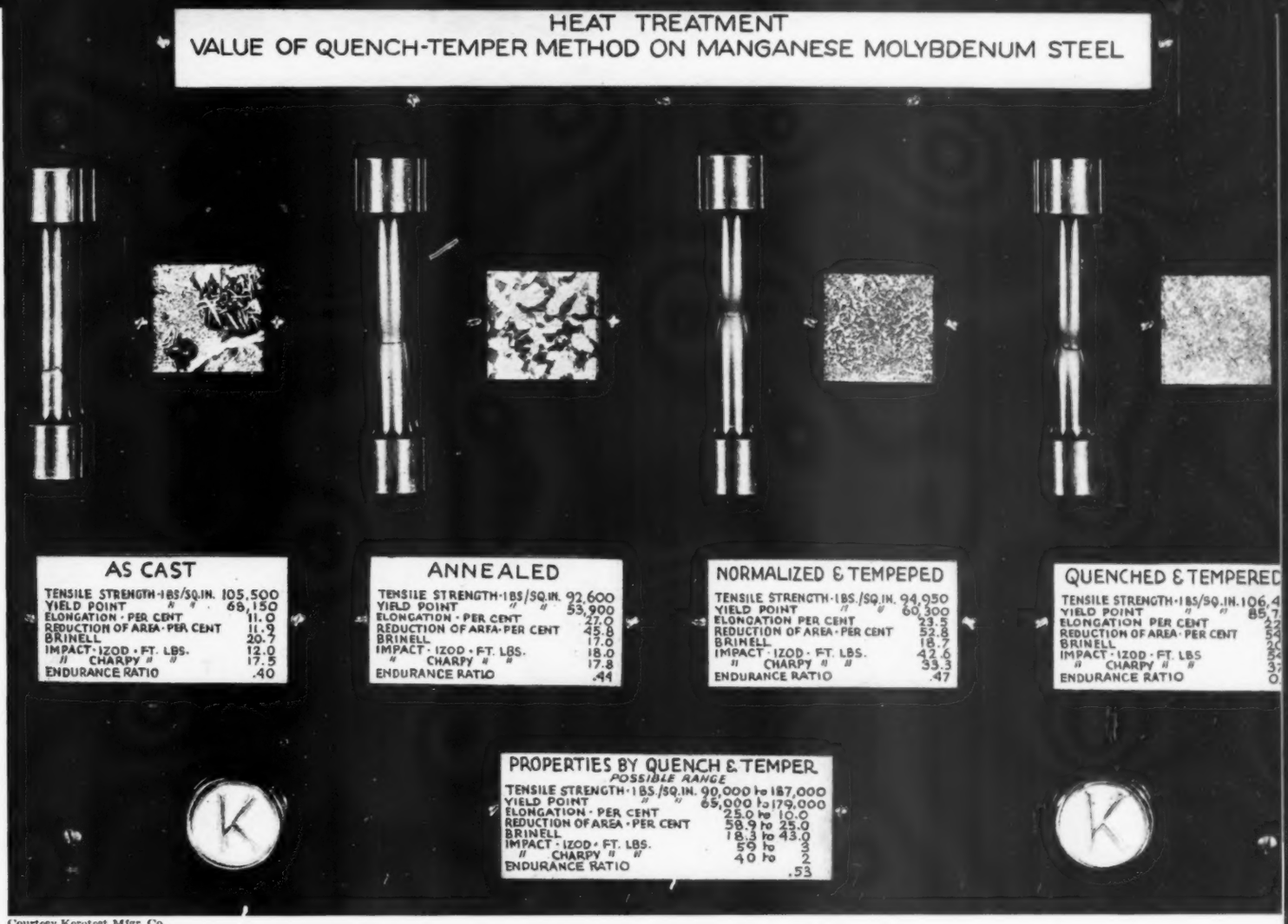
By the introduction of alloys, it is possible to produce steel having greater strength for a given ductility, or greater ductility for a given strength than is possible with the best made carbon steel. Also, as a rule, alloy steels have greater resistance to wear and abrasion.

There are five alloys in general use today for the production of Pearlitic and Sorbitic alloy steels, namely, Nickel, Molybdenum, Chromium, Vanadium, and Manganese. The various combinations of these alloys make possible a surprisingly large number of alloy steels adaptable for castings.

The value of Molybdenum as an alloy for steel castings was not recognized prior to 1922. The first use of this element as an alloy for steel was in combination with tungsten and chromium in relatively large percentages, for the manufacture of high speed steel.

Molybdenum's valuable service in imparting impact resistance was recognized during the World War in the manufacture of steel for use in heavy field artillery. Modern high explosives demand the utmost in shock resistance of the steel used to manufacture guns, and Molybdenum Alloy steel (heat treated) has proved the best answer to this problem.

The Kerotest Manufacturing Company,


HEAT TREATMENT
VALUE OF QUENCH-TEMPER METHOD ON MANGANESE MOLYBDENUM STEEL
AS CAST
TENSILE STRENGTH-LBS/SQ.IN. 105,500
YIELD POINT " " 68,150
ELONGATION - PER CENT 11.0
REDUCTION OF AREA - PER CENT 11.9
BRINELL 20.7
IMPACT - IZOD - FT. LBS. 12.0
" CHARPY " " 17.5
ENDURANCE RATIO .40
ANNEALED
TENSILE STRENGTH-LBS/SQ.IN. 92,600
YIELD POINT " " 53,900
ELONGATION - PER CENT 27.0
REDUCTION OF AREA-PER CENT 45.8
BRINELL 17.0
IMPACT - IZOD - FT. LBS. 18.0
" CHARPY " " 17.8
ENDURANCE RATIO .44
NORMALIZED & TEMPEPED
TENSILE STRENGTH-LBS./SQ.IN. 94,950
YIELD POINT " " 60,300
ELONGATION PER CENT 23.5
REDUCTION OF AREA - PER CENT 52.8
BRINELL 18.7
IMPACT - IZOD - FT. LBS. 42.6
" CHARPY " " 33.3
ENDURANCE RATIO .47
QUENCHED & TEMPERED
TENSILE STRENGTH-LBS/SQ.IN. 106,4
YIELD POINT " " 85,7
ELONGATION PER CENT 22
REDUCTION OF AREA - PER CENT 5
BRINELL 2
IMPACT - IZOD - FT. LBS 5
" CHARPY " " 3
ENDURANCE RATIO 0
PROPERTIES BY QUENCH & TEMPER
POSSIBLE RANGE
TENSILE STRENGTH-LBS./SQ.IN. 90,000 to 187,000
YIELD POINT " " 65,000 to 179,000
ELONGATION - PER CENT 25.0 to 10.0
REDUCTION OF AREA - PER CENT 59.9 to 25.0
BRINELL 18.3 to 43.0
IMPACT - IZOD - FT. LBS. 59 to 3
" CHARPY " " 40 to 2
ENDURANCE RATIO .53

Courtesy Kerotest Mfgr. Co.

Figure 2

after experimenting with many different types of alloy steel adopted Manganese-Molybdenum as its standard early in the year 1922. The application of Molybdenum as an alloy for steel valve castings was pioneered by this company. The first Molybdenum heat was made in January, 1922, and its analysis was Carbon .20, Molybdenum .27, Manganese .43. The castings and test bars were only annealed but showed sufficiently good physical properties to warrant further trials. Many heats with varying percentages of Carbon, Molybdenum, and Manganese were then made and the result of this series of experiments was to standardize the combination now known as Manganese-Molybdenum or M.M. Steel.

When the first heats of Molybdenum steel were made, annealing was the usual treatment for steel castings. Annealing at that time was not under the exact control that exists today because furnace and pyrometer equipment was vastly inferior to that now in use. Figure 3 illustrates the modern heat treating and annealing furnace in use today. Doors and cars are operated by push buttons, and temperatures are regulated by automatic recording control pyrometers. Furnaces are heavily insulated and the furnace atmospheres so regulated as to insure uniform heating throughout the load. Handling the hot castings from furnace to quenching tank is accomplished by a crane carrying an automatic latch which permits the transfer with a minimum loss of temperature.

But annealing, however well performed, fails to produce the best combination of physical properties for Manganese-Molybdenum or any other Pearlitic alloy steel. Normalizing followed by a tempering treatment was the next improvement, and the physical results so produced are very much superior to those for annealed steel. However, as has already been shown in discussing carbon steel, the maximum combination of shock resistance and high tensile strength was arrived at only by full heat treatment. That is, by liquid quenching from a temperature just above the critical range, followed by a tempering or draw treatment just below this range.

Figure 2, shows the physical properties

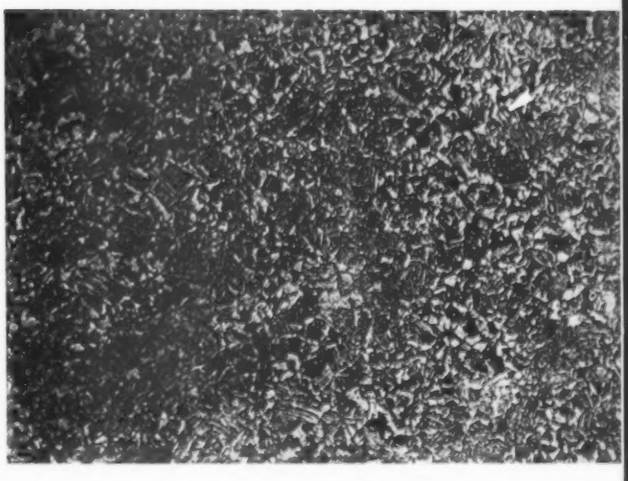
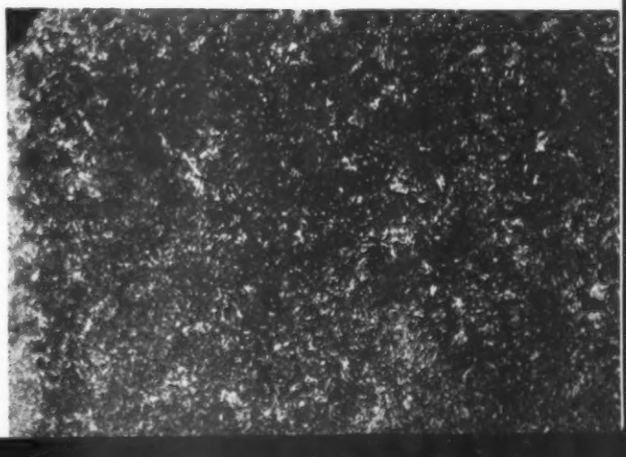


Figure 6

Figure 7



and structures of cast Manganese-Molybdenum steel in four typical stages: A—"as-cast"; B—Annealed; C—Normalized and Tempered; D—Quenched and Tempered. Figures 4, 5, 6, and 7, illustrate better the micro-structures and the progressive refinement in grain structure from "as-cast" to the annealed, to the normalized, and to the quenched and tempered state. The structure shown in Figure 7 is produced by a liquid quench followed by a tempering treatment at 1,250 deg. F. The chart shown in Figure 8, shows the variation in physical properties which can be accomplished with Manganese-Molybdenum steel if the tempering treatment be varied from 500 deg. F. to 1,300 deg. F.

A study of Figure 2 reveals the superior

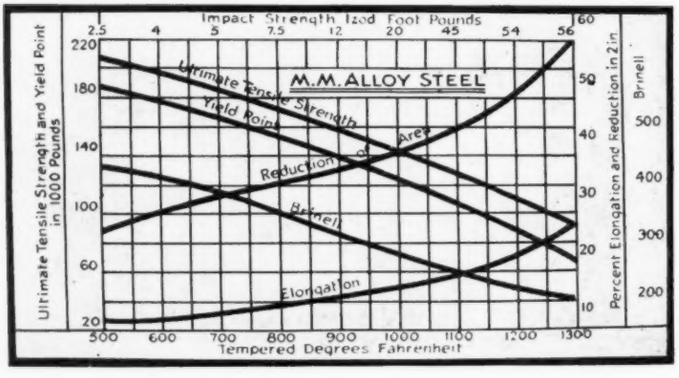


Figure 8

properties of Manganese-Molybdenum steel, and the effects of various heat treatments upon structure and physical properties.

Tensile Strength:

The "as-cast" bar has a tensile strength of 105,500 lbs. per square inch. This is lowered 12 percent by annealing and 10 percent by normalizing but is increased to 106,400 lbs. per square inch by quenching and tempering.

Yield Point:

Yield Point has greater importance than tensile strength when placing a valuation on the properties of a steel, because a steel which has been stressed beyond its yield point is ruined and fit for nothing but remelting.

The yield point of the "as-cast" bar is 68,-150 lbs. per square inch. This is lowered 21 percent by annealing and 11.5 percent by normalizing, but is increased to 85,780 lbs. per square inch by quenching and tempering, or nearly 60 percent better than the annealed bar.

Elongation:

Elongation in the "as-cast" M.M. bar is 11.0 percent which is increased to 27.0 percent by annealing, and shows 23.5 percent and 22.6 percent respectively in the normalized and the quenched and tempered bars.

Reduction of Area:

The "as-cast" bar shows 11.9 percent reduction of area. Annealing increases this to 45.8 percent, normalizing to 52.8 percent, and quenching and tempering to 54.6 percent.

Impact Test:

As was the case with carbon steel, the most gratifying and significant improvement accomplished by heat treating is revealed by the impact test results. In the "as-cast" condition M.M. steel shows only 12-foot-pounds by the Izod test. The annealed bar shows 18 foot-pounds which is a 50 percent improvement; the normalized bar shows 42.6 foot-pounds or 255 percent better than the "as-cast" bar; the quenched and tempered bar shows 54.0 foot-pounds or 350 percent improvement over the "as-cast" bar, and 200 percent better than the annealed specimen.

The practical limits for hardness in alloy steel valves lie between 200 and 225 on the Brinell scale. This represents a tensile strength somewhere between 100,-000 and 110,000 lbs. per square inch. With tensile strength at this figure Manganese-Molybdenum steel heat treated has the unusually high figure of 54 foot-pounds Izod.

Aside from the unusual combination of high tensile strength and resistance to shock found in Manganese-Molybdenum steel there are many reasons for its adoption as an ideal alloy steel for the manufacture of valves and fittings. As compared to chromium or nickel steels or chrome-nickel steel, it is less likely to contain checks and internal tears and shrinkage defects not discernible by surface inspection.

During the melting and refining operations, Molybdenum does not oxidize and consequently the Molybdenum content of a bath of metal can be controlled with certainty. This fact assures the proper percentage in the melt and in all parts of the castings.

The improvement in the material used for valves has gone hand in hand with improvements in workmanship in foundry and machine shop. Valve castings today must leave the foundry with a minimum of machine finish, and must be cleaned and ground until free of all adhering sand and surface defects. Cores must clean out of castings leaving smooth perfect surfaces. Great ingenuity has been exercised and in the study of heading, gating, and chilling to produce valve castings which are free from shrinks and internal defects of all descriptions. Improvements in heat treating technique have been previously discussed.

In the machining of valves, jigs and fixtures are employed assuring interchangeability of all valve parts. Machine operations are held to closer tolerances, which means better fits, and all machined surfaces must have finer finishes with removal of tool marks and better workmanship in all respects than the valve of yesterday.

▼

Vacuum (Ireland) Ltd.

ON THURSDAY, May 30th, Mr. F. E. Powell Jr., Director of the Vacuum Oil Company Limited, presided at a luncheon in the Shelbourne Hotel, Dublin, and announced officially the formation of the Vacuum Oil Company (Ireland) Limited.

A large number of guests attended from various parts of the Irish Free State. Mr. Powell said:

On and after Saturday the 1st of June the old established business of the Vacuum Oil Company takes on a new meaning in Ireland. On this date the newly formed Vacuum Oil Company (Ireland) Ltd. commence operations as sole marketers in Saorstat Eirann of Mobiloil and the Gargoyle Lubricating Oils and Greases.

Coincident with this change is the appointment of Mr. C. G. Reeves as Director and Manager of the new company. Mr. Reeves will be supported by Mr. W. A. Devin, whose appointment as Director is also announced.

For over forty years the Vacuum Oil Company has marketed its products in Ireland.

▼

OUR FRONT cover picture this month shows the head office of the Anglo-American Oil Company flood lighted in connection with the Silver Jubilee festivities in London. Published through the courtesy of THE LONDON TIMES.

Washington Considers Modified Control

Revision of Thomas Bill Significant of Changed Attitude—Enactment of Any Special Legislation Depends on President—Other Regulatory Measures Being Pushed. ***By Don J. Kirkley***

WASHINGTON, JUNE 29

TWO POSSIBILITIES of legislative action confront the American oil industry today as Congress turns into the homestretch toward session adjournment, probably between July 15 and August 1, one as likely to come to pass as the other on the basis of present indications.

They are, briefly put:

(1) Enactment of the new substitute for the Thomas bill, providing for joint state-Industry-Federal cooperation and regulation.

(2) A return to unfettered competition and production, with such regulation as there is guided solely by the producing states through a compact.

Marked by tremendous rumblings of general uncertainty over the country about what the Administration may do to rehabilitate NRA, the situation in simplest words indicates that whether oil as an industry will be the recipient of special legislation depends upon:

(1) How long Congress is in session.

(2) The extent to which President Roosevelt will go in waging an active campaign for petroleum laws.

If Congress adjourns prior to July 15, as the private plans of leaders provide for (subject to the President's unstated desires) any oil legislation in all probability would be limited to ratification of an interstate compact between producing commonwealths and enactment as a permanent statute of the Connally law preventing interstate shipments in excess of state restrictions and which expires in June of 1937.

Should Congress stay around Washington until August 1, there is a greater chance that oil legislation would cover the above stated points and include:

(a) Provision for advisory allocations of crude production to meet demand and prevent physical waste, by the central government, which could operate in states not participants in a compact or lacking state laws.

(b) Limitation of imports to around 100,000 bbl. daily.

(c) Authorization for voluntary agreements covering new pool development, marketing and refining problems.

All these are provided in the substitute for the regimentary oil control bill bearing the name of Senator Elmer Thomas of Oklahoma and approved by the Senate Mines Committee. The substitute, introduced by Thomas on June 14, provides a much milder treatment than the original measure.

Of chief significance is the provision of Section 7 in the substitute, which stipulates that "when and only when" crude was being produced in excess of needs, and after extensive hearings, could the Federal Petroleum Board provided for in the measure put into effect quotas of oil and products to move in commerce.

The quotas-in-commerce idea, after exhaustive study by the Administration's legal lights, has been held, quite privately, to be constitutional in the light of the Supreme Court's decision that reduced the NRA to a stack of bones and a heap of singed feathers.

Weighing what President Roosevelt said at press conferences during June, in which he dealt at some length with oil, against the Thomas bill substitute, it would appear that the revised measure would do what he said he would like to see done, and no more. The Executive made it clear that he wanted the federal government kept well in the background and the states and industry given a chance to prevent economic disorder and waste, with a minimum of federal assistance.

This clear definition of what he had in mind delivered in the semi-privacy of press conferences, the President said publicly that he wanted the Petroleum Administration continued, and he placed continuing legislation on the "must" list of preferred legislation he would like to see passed before Congress adjourns.

But the political wiseacres are unable as yet to determine whether it is in the category of things Mr. Roosevelt would like to have or in the list of things that he will insist he has to have to carry on his national rehabilitation program. The slight distinction means that if it is in the "like to have" group, it could be tossed overboard to get Congress out of town without even a crocodile tear splattering.

The Texas delegation still holds the answer to the legislative situation and is still holding its lines against legislation. So far, Senators Connally and Sheppard, flanked by Vice President Garner and Representative Rayburn, have kept the measure from coming to a vote in the Senate, where it graces the calendar and has for weeks. Connally and his cohorts have refused to be won over by the substitute, the Texan explaining for WORLD PETROLEUM:

"The Administration tried nationalization in the NRA and look where it got. This is just the same old nationalization bill, maybe with a new suit of clothes. Texas is quiet and has conditions under control. I don't get any telegrams clamoring for this bill. Why should we pass it when we don't need it?"

In the wake of the destruction of the NRA and its code provisions and machinery, the petroleum industry, like all others, moved to retain what it considered code benefits through whatever means available to it. The American Petroleum Institute went along in efforts to work out trade practice rules under the Federal Trade Commission and was planning to take the question up in detail with the Commission during July.

The greatest uncertainty is over oil and over whether the Administration will move toward a partial suspension of the anti-trust laws to permit voluntary agreements in excess of the Federal Trade Commission's requirements. Agreements regulating production are distinctly in violation of the anti-trust laws, which would throw out the refinery control program as carried on under the code and most of the marketing rules, since the latter look toward price control.

No responsible observer will guess at this moment whether there will be a determined movement to suspend the anti-trust statutes. The better authorities are inclined to believe that there will not be, insofar as all industries are concerned, exclusive of those which may get special legislative treatment. This is based upon a belief that such action would weaken the hinted-at but unannounced fundamental campaign to revise the Constitution so as to permit economic direction from Washington.

© Aerial Explorations, Inc.

Air view of the International Petroleum Company's camp at Talara, Peru. Employees' cottages may be seen at left.

Welfare and Sanitation in Tropical Fields

Organized Activities of International Petroleum Company for Health, Education and Social Welfare of Employes in Colombia and Peru

SINCE oil company operations in many cases are carried on at points remote from centers of population and in more or less primitive surroundings the provision of means of guarding the health of employes, providing suitable housing and educational facilities, and supplying means of social recreation, is one of the problems, or rather series of problems, to which special attention must be given. In tropical fields particularly workers must be guarded carefully against the dangers of certain diseases while housing, sanitation, education and recreation are all among the responsibilities of the operating company.

Special attention has been given to the provision of these facilities by the International Petroleum Company Ltd. in its operations in Peru, and by its affiliated organization, the Tropical Oil Company, in Colombia. Although the two countries differ widely in climatic and physical characteristics similar methods have been employed in both with great success in many phases of health and welfare work. A brief mention of some of these activities may be of interest to oil company men in other parts of the world.

In Peru the oilfields are located along the arid northwest coastal region where the climate is tempered by the cold Humboldt current which sweeps up the coast from the Antarctic region, producing an effect opposite to that which the Gulf Stream exercises on the countries in Northwestern Europe. Opposed to this Humboldt current is an intermittent south bound current originating in equatorial waters, which at times diverts the cooler stream, causing a temporary rise in temperature and at rare intervals rainfall along the coast. The Peruvian coastal region is, as a rule, free from extremes of heat and cold. During the height of the summer and in the warmest localities the thermometer rarely goes above 98° F. with a usual maximum of 90° as the pre-

vailing sea breezes alleviate considerably the high temperatures. The average during the cool season is 70° and it is only on rare occasions that the temperature drops below 55°.

In Colombia on the other hand, the oilfields are located some 400 miles in the interior in the valley of the Magdalena River, about 7° north of the equator and 450 feet above sea level. The vegetation is dense and the climate is typically tropical. The average rainfall is about 130 inches per annum and the average temperature around 82°, the humidity being high. There are two well defined seasons. The rainy seasons last from April to June and from October to December and the dry seasons prevail for the remainder of the year.

Under such diverse climatic conditions and with more hazardous problems to contend with in Colombia than in the more favored coastal zone of Peru, the measures required to ensure the health of the employes are of necessity entirely different in the two countries, though the welfare work is common to both. A primary consideration in Peru, where a real rainfall comes only in cycles of thirty years, is an adequate fresh water supply for both domestic and industrial purposes. This the company secured from the Rio Chira, about 25 miles south of the oilfields, where it maintains a fresh water supply plant with sedimentation tanks and filters and a distribution system to the field for its various activities, and to the camps with their population totalling some 21,000 persons, for domestic purposes. This water supply is carefully checked by frequent bacteriological tests.

While it was not necessary in Colombia to go so far afield for a water supply, a similar plant has been installed and the same efforts made to safeguard the health of the community in addition to meeting the industrial needs of the field.

During the years that the International Petroleum Company has operated in Peru, it has been realized that the health of the workers is of paramount importance, and that one of the prime essentials in a healthy community is proper sanitation. Commencing in 1920 the company gradually rebuilt the native camps, both in the producing field and at the port of Talara, installing modern sewage systems and providing living quarters with flush toilets, bath houses and laundries. General policing of the camps ensures that conditions are kept up to standard and all feasible preventives against disease are compulsory, such as smallpox vaccination, medical examination of food handlers and periodic examinations of school children as a safety measure.

The result of this campaign has been a remarkable improvement in the general health and well-being of the people, with a corresponding reduction in the death rate, especially among infants.

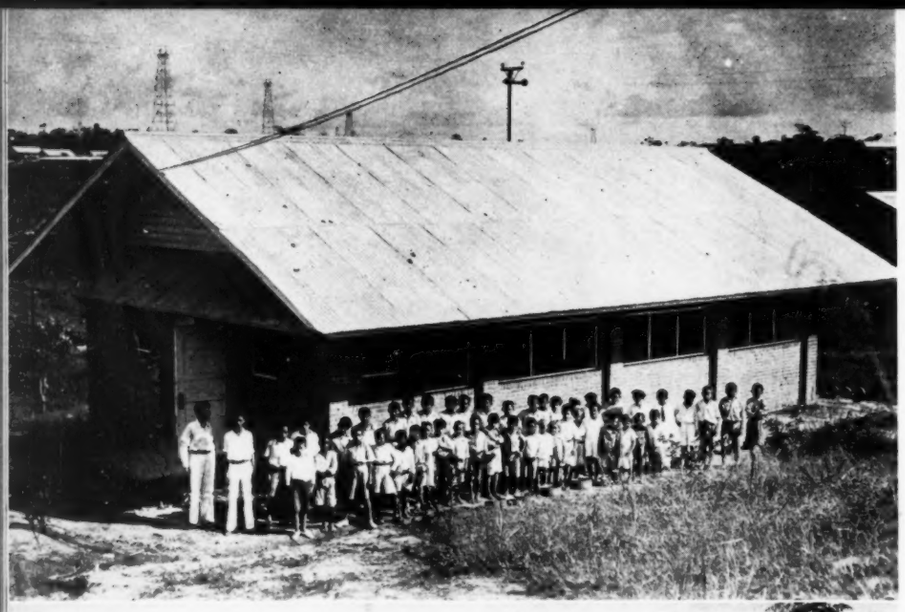
Brush has been cleared away and sanitation ditches put in about this camp of the Tropical Oil Company in a Colombia producing field. The school, workmen's quarters, dispensary and commissary may be seen in the picture.

Soccer game on one of the company's athletic fields in Colombia.

In Colombia where the climate aggravates the situation, the sanitary measures of necessity had to be more extensive and intensive than in Peru. Corresponding housing and sanitation schemes are provided and similar preventive measures are carried out, but in addition the company has to maintain a continuous campaign against malaria. The work of the Sanitary Department is, therefore, extended to include anti-mosquito measures, the initial cutting and clearing of brush, the construction of drains, the disposal of garbage, disinfecting of buildings and the maintenance and care of sanitary installations and existing clearings.

In both countries hospitals and complete medical organizations are maintained by the company, providing free medical attendance and every facility of modern surgery for all employes.

The disability record of employes in Peru showed a frequency rate of 235 per thousand during 1933 which was somewhat higher than during the three preced-



Boys and girls schools in the oilfields at Colombia maintained by the Tropical Oil Company.

ing years due to an outbreak of influenza. The number of days lost per employe, however, was only 2.67. That this rate is low is indicated by the fact that in temperate climates the average person loses six days per annum on account of disability.

In Colombia it is of particular interest to note that the malaria rate for employes has been reduced from the peak year of 1926, when it stood as high as 845 per thousand, to the low figure of but 10.78 per thousand in 1933. The general health of the Tropical Oil Company's camps is excellent and during the past year there was no serious epidemic, while the diseases which usually are responsible for the major portion of tropical disability are now so well under control that the frequency rate for sickness is remarkably low. This rate for the year 1933 was 294 per thousand, and the days lost per employe 3.52. When compared with conditions which existed in the early days of the company's activities, it is almost unbelievable that the oilfields have now far less sickness than the average healthy community in the United States.

Other measures instituted by the company for the welfare of employes are the maintenance of safety departments in both countries which are actively educating the workmen in accident prevention. The importance of safety precautions is presented on the bulletin boards in all departments, by safety literature, the dissemination of safety instructions and regulations for particular classes of work, the displaying of posters at the most frequented places, traffic and danger signs, payroll envelope enclosures and safety talks to groups of workmen by the inspectors. There are also "Help-Save-A-Life" boxes in which the employes are encouraged to place their safety suggestions, and the use of safety equipment is insisted upon in all hazardous occupations.

That the efforts of this department have been successful is indicated by the results secured. During the past year in Colombia, the frequency rate per million man hours worked was only 12.10, as compared with 114.69 for the year 1928. In Peru the frequency rate at the refinery was only 4.78 and in the producing field 13.76. The figures represent a reduced loss to the employers by reason of time lost through accidents, and compare very favorably with the frequency rate of 13.00 for all departments and companies in the United States reporting to the Department of Accident Prevention of the American Petroleum Institute.

In both Peru and Colombia the welfare of the employes is the first consideration of the respective managements, and in every line of endeavor the company caters to the recreation and well being of those who are dependent upon it for their livelihood. Sanitary and suitable housing

Aerial Explorations, Inc.

Air view of Talara, with the desert from which the crude oil comes, in the background.

accommodation is provided, the camps being under the control of town managers and sanitary inspectors who are responsible for the physical comfort of those under their charge. In the sphere of recreation the company has provided club houses fully equipped for the use of all employes and has laid out playing fields for the promotion of athletic activities.

The advantages of a liberal education have been fully realized and model schools are to be found in all of the larger camps. That the natives take advantage of the educational facilities is shown by the good attendance maintained at all of these schools. With this educational ground work the boys upon leaving school usually become apprenticed in the various shops and works or in the field, rapidly becoming trained in their several trades and representing the company's personnel of the future.

For amusement and as a further educational avenue cinemas have been built and great interest is evinced in such entertainments. The competitive spirit prevailing in athletic contests, particularly in football, is evidence of the fact that the employes are alive to and appreciative of the facilities provided.

The general morale of the Peruvian and Colombian workmen in the employ of the International Petroleum Company Limited is excellent, and the esprit de corps compares most favorably with that to be found in the ranks of any of the large oilfields operating in the United States.

Company playing field at Negritos, Peru: view taken during celebration of a national holiday.

Foreign Oil Legion

W. R. MOOK has recently become president of the Standard Export Company succeeding D. L. Harper.

J. A. BROWN, Chairman of the Management Committee of Socony-Vacuum Oil Company has become president of that company in addition to his position as chairman of the management committee. Charles E. Arnott, former president, has relinquished his position in order to have more time to devote to his work for stabilization of the petroleum market. Mr. Arnott retains his connection with Socony-Vacuum as a vice-president.

PEDRO NEL OSPINA, managing director and Cipriano Restrepo, vice-president of the newly formed Soc. Nacional del Carare of Colombia visited New York for several weeks during May and early June in connection with business of their company. This company was formed to lease from the Unión Colombiana de Petróleos an 80,000 acre tract of land which the latter company originally acquired as a concession from the Colombian Government under the provisions of the Law of 1931. The concession is situated in the Magdalena River basin south of the Carare River adjacent to the only present commercial producing property in the country. Although preliminary reconnaissance work has been carried out the immediate program of the management is for a detailed geological study with subsequent test drilling to prove the field. The structural and lithological evidences disclose very certain possibilities and early production is anticipated. Notwithstanding that the concession is some 360 miles in the interior, which renders it quite inaccessible to the Atlantic seaboard, it is very favorably situated for the development of a local production and refining enterprise. The company is entirely of private and native origin, capitalized at $800,000 which is fully paid up. Sixty percent of this capital was subscribed by the Compañía Colombiana de Tabaco and the remainder by Colombian individuals.

M. T. LLOYDS, managing director of Commonwealth Oil Refineries, Ltd., is now in London on several months' leave, during which time he will confer with Sir John Cadman with regard to the geological exploration being carried out in Australia by Anglo-Persian geologists.

Sr. Cipriano Restrepo, vice-president (left) and Sr. Pedro Nel Ospina, managing director of the newly formed Soc. Nacional del Carare.

Sir Ernest Miller.

ERNEST MILLER, General Manager for India of the Burmah Shell Oil Storage and Distributing Company of India, Ltd. recently received the title of Knight Bachelor conferred on him by H. M. King George V. Mr. Miller retired from business in India early in May and returned to England. Mr. Miller went to India in 1902 at the age of 23 and joined Messrs. Eward Ryrie and Company. During the war he enlisted in the Scots Guards and was twice wounded, the second time so seriously as to prevent him from further active service in France. He came to America for six months on the business of the British War Office. At the conclusion of the war he returned to India, joined Asiatic Petroleum Company in 1921. When the Burmah-Shell was formed in 1928 he joined it and the following year devoted himself to developing the Indian market. He was president of the Bombay Chamber of Commerce and later a member of the Bombay Legislative Council and finally of the Council of State. Mr. Miller devoted himself largely to developing communications.

C. A. MOON, field manager of the Trinidad Petroleum Development Company Ltd., and Neils Matheson, field manager of British Controlled Oilfields Ltd., left for London early in May for two months' leave. They met on the MANHATTAN, neither knowing that the other was on board. Mr. Matheson was formerly with the British Burmah Petroleum Company Ltd. Mr. Moon was formerly with the Iraq Petroleum Company, later joining the staff of British Controlled as assistant to Mr. Matheson.

UNITED STATES

	Daily Crude Oil Production bbl.	Daily Runs to Stills bbl.	Total Motor Fuel Stocks bbl.	Imports for week bbl.	California Shipments East for week bbl.
Week ending May 25	2,625,000 473,000*	2,685,000	64,596,000	1,065,000**	399,000
Week ending June 1	2,585,000 468,000*	2,625,000	64,978,000	1,343,000**	none
Week ending June 8	2,655,500 472,000*	2,510,000	64,016,000	668,000**	272,000
Week ending June 15	2,738,500 476,000*	2,690,000	63,411,000	1,024,000**	

Underlined figures indicate improvement in statistical position—decrease in production, runs to stills, gasoline stocks and imports.

* Estimated total production of the Rusk-Greggfield, East Texas, official and unreported.

** Import figures include all oil imported, for domestic use and in bond for re-export, it being impossible to make the separation in weekly statistics.

The Passing of NIRA

As was reported in the preceding issue of World Petroleum the National Industrial Recovery Act was declared unconsitutional by the United States Supreme Court on May 27 and during the past month the government, business and labor circles were readjusting themselves to the radically changed conditions. Unquestionably a large majority of responsible public opinion welcomed the end of NRA though at the same time several important accomplishments are definitely credited to it. The elimination of child labor, improvement in wages and in working hours, collection and dissemination of accurate industrial statistical data, sponsorship of trade organizations are recognized and will be undoubtedly carried over. As far as the influence of the Supreme Court's decision on the business trend is concerned it is generally held that inasmuch as the economic basis of NIRA was unsound any possible temporary disturbances caused by its elimination will be more than offset by permanent benefits. One of the immediate favorable effects already observed is a more careful perusal by Congress of legislation under consideration with the view to its constitutionality, and much of the "must" legislation has been accordingly revised.

Affecting the oil industry immediately the Supreme Court's decision invalidated the following more important NRA institutions and agreements:—the Planning and Coordination Committee, which will suspend its operations on July 21; the Petroleum Administrative Board, which, however, may continue under new NRA as a fact-finding agency without any regulatory powers; the Petroleum Labor Policy Board, whose abolition cancelled the pending government's action against several major oil companies, including the Texas Company and the Continental Oil Company; and the Pacific Coast Refiners Agreement, which was immediately followed by a mild "price war" and serious crude oil overproduction.

With Congress due for Summer recess strong efforts are being made by Secretary of the Interior, H. L. Ickes, and by the groups desiring limited federal control of the oil industry to force through the altered Thomas Bill, which currently provides for ratification of intrastate oil compacts, now approved by five principal oil producing states, and for a federal board of five members under the Department of the Interior, in fact similar to the Petroleum Administrative Board, with rights sufficient to exercise effective control within states, a feature which has been repeatedly held unconstitutional in courts. For this reason the new Thomas Bill is strongly opposed by the Governors of the oil producing states, and it does not appear to have much chance of being passed at this session.

The board of directors of the American Petroleum Institute met in New York on June 5 to consider the decision of Supreme Court and the board recommended to the industry:—(1) the maintenance of present wages and hours and the non-employment of child labor; (2) the sanction of interstate compacts by Congress; (3) the permanent transfer of fact-finding agencies from Petroleum Administrative Board to the United States Bureau of Mines; and (4) the cooperation with state conservation authorities in enforcing existing conservation laws.

The Wheeler-Rayburn utility holding company bill and the Wagner Labor Disputes Bill continue to be debated by the Congress at this writing.

Texas Conservation Laws Upheld

The Texas Supreme Court on June 12 not only upheld the right of the Railroad Commission to regulate the spacing of oil wells under Rule 37 in the interest of conservation, but also definitely ruled that it was the Commission's duty to do so, in the cases of C. H. Brown and the Railroad Commission against Humble Oil and Refining Company and of Maurice Stewart against the Railroad Commission. The Court stated that: "We hold that the Railroad Commission has the power, under the conservation statutes, to promulgate a spacing rule as was done, regulating drilling of oil wells, and to provide for exception to the rule to protect vested rights and to prevent waste; and the exception to this rule is not too uncertain or indefinite so as to render the rule invalid. No unreasonable hardship need result if the rule is faithfully and impartially applied by those authorized by law to administer it." Relatively of even greater importance was the section of the ruling which definitely prohibited granting of the drilling permits on subdivided tracts, the court saying that: "where rule 37 is in force in a certain territory a voluntary subdivision of a tract of land subject to development for oil and gas as a whole would not entitle the owners of said divided tract, or tracts, as a matter of right, to an exception of rule 37 on the ground of vested rights, because such act would destroy the rule and render the conservation laws a nullity." The ruling of the Texas Supreme Court will probably be of not too much influence in the East Texas field with its 18,000 oil wells and many more to be drilled, but it is expected to control effectively development of all new pools. A most interesting and as yet undecided aspect of the decision is the problem of well allowables and of the marginal well law, since the ruling clearly gives preference to wells on larger tracts.

The first state sale of illegally produced crude oil appeared to be a mere formality with crude oil, some 22,000 bbl., having been bought back by the original owners at 40 cents per barrel, because of the fact that the owners, the Master Petroleum Company, presented evidence showing that the oil was bought on good faith. The new confiscation law, however, was due for a test on July 1 before the three-judge federal court in Houston. Four suits were consolidated into one test case. Some 3,000,000 bbl. of illegally produced oil is due for confiscation and sale, though the state authorities planned to proceed slowly in order not to depress the market unduly. It is not expected that the confiscated oil will bring full posted price at any sales since it is of inferior grade having been in many instances left exposed for long periods of time in open earthen pits.

Current "hot" oil production in East Texas further declined during the past month to around 15,000 to 20,000 bbl. per day, or well within limits not affecting current market quotations outside of a very limited area near the field.

Texas officials thus continue to exercise their authority fully throughout the state oil fields and the end of the NRA is not likely to change the situation. If anything, the state conservation agencies will attempt even stricter enforcement to prove their ability to control the production without federal inter-

ference. State control of crude oil production is considered at this time to be fully effective in Texas, Oklahoma and Kansas, and the oil industry feels reasonably certain that in these three states the quotas to be set by the Bureau of Mines, as proposed by the American Petroleum Institute, will be voluntarily followed.

Serious Overproduction in California

INVALIDATION of the NIRA and of the Petroleum Code left California without any regulatory measures, and the state's production immediately increased from the May average of around 490,000 bbl. per day to 555,000 bbl. per day for the week ending June 8, and further to 575,000 bbl. per day for the week ending June 15, as compared with the recommended federal quota of 512,700 bbl. per day. The retail gasoline markets broke simultaneously, the third grade motor fuel selling for as low as 9 cents per gallon in Los Angeles, all taxes included.

On June 7 a mass meeting of all oil producers was held in Los Angeles. At that meeting the voluntary "Code of Fair Competition for the Petroleum Industry" was unanimously reaffirmed in the same form as it existed under NRA, and the operators declared themselves in favor of strict proration under direction of the Oil Umpire. In the meanwhile the major purchasers definitely indicated that continued overproduction will force a cut in the posted crude oil prices, while production within limits set by the Oil Umpire may result in higher quotations. At best the developments in California are of local interest and will not directly influence either Mid Continent or Eastern markets unless a wide break occurs in California. Known reserves of California, however, are so limited that they would not permit a large overproduction for an extended period of time, more particularly because all newer flush fields are in the hands of major operators who observe all proration quotas.

Prices Continue Firm

THE END of NRA naturally brought some temporary nervousness into the crude oil and products market, though subsequent developments alleviated any fears and in general prices continued firm with an upward tendency. Important favorable influences were the strict enforcement of crude oil production in East Texas and limited extent of retail motor fuel "price wars", which seriously affected only the Los Angeles basin area on the Pacific Coast.

During the past month refinery gasoline quotations remained steady and even strengthened somewhat while retail motor fuel prices remained unchanged with the exception of a 3½-cent cut in Los Angeles between June 5 and 8, and 4-cent reduction in Boston, Mass., on May 31 and June 11. On the other hand the Standard Oil Company of Ohio on May 29 advanced tank wagon and service station prices ¼ of a cent per gallon throughout its territory; and on June 14 the Standard Oil Companies of Indiana and Nebraska advanced their quotations 0.3 cents per gallon throughout their territories. Local buying of legally produced and refined distress refinery gasoline by major purchasers continued to exercise a healthy influence on the price structure. Natural gasolines and kerosenes remained unchanged during the past month, while crude oil prices continued firm.

Posted crude oil prices during June remained unchanged at $1.00 per barrel for 36 gravity Mid Continent grade, and $1.00 flat per barrel for the East Texas crude. Overproduction in California threatened the crude oil price structure there but the situation appeared to be improving by the close of June, though some crude oil from Playa del Rey field sold 15 to 20 cents under the posted price of $1.00 per barrel. With the continued effective control of crude oil production in the Mid Continent and curtailment in California a small increase in crude oil prices appeared very likely, inasmuch as with the invalidation of artificial price legislation the prices will more quickly respond to both favorable and unfavorable influences.

Tank wagon/service station motor fuel prices per gallon, regular grade, including all taxes, in representative districts in the middle of June were: 14.55/18.3 cents in metropolitan New York (13.3/16.8 cents in Newark, N. J.); 11.0/12.5 cents in Boston, Mass.; 12.0/15.5 cents in Providence, R. I.; 15.5/17.5 cents in Chicago; 17.0/19.0 cents in Ohio; 16.5/18.5 and 12.5/14.5 cents in San Francisco and Los Angeles respectively, with some independents selling third grade product for as low as 9 cents per gallon in Los Angeles, all taxes included; 16.0/18.0 cents in Oklahoma; 15.0/17.0 in Dallas, Fort Worth and Houston, Texas (in Dallas and Fort Worth third grade product sold down to 11 cents per gallon, but the reduction was not followed by major marketers and the retail markets remained firm); 15.2/17.2 cents in St. Louis and East St. Louis; and 24.0/27.0 cents in Montreal, Canada; all with a 2-cent differential for premium grade.

Late in the month a price war broke out in Montreal when an independent marketing organization began distributing Roumanian gasoline at cut rates.

Refinery gasoline quotations in the Mid-Continent area advanced around ⅛ of a cent during the past month. Refinery gasoline was quoted on June 20 at 4¾–4⅞ cents per gallon for 58–60 U.S.M. grade 62.9 and below octane rating in Group 3, Oklahoma market; 63.0–70.9 octane rating, U.S.M., "regular" grade, was quoted at 5⅝–5⅞ cents per gallon; and 71 and above octane rating, U.S.M., "premium" grade, brought 5¾–5⅞ cents per gallon. East Texas markets were strong with prices on a par with Group 3 quotations. On the East Coast, at Bayonne, U.S.M. grade 60.0–64.9 octane rating gasoline was quoted at 5¾ cents per gallon (3.40 cents gold *). Gulf Coast prices for export advanced ½ of a cent per gallon above May 20 quotations and on June 20 were between 5⅛ and 5¼ cents per gallon (3.02 cents gold *) for grade 58–60 U.S.M.

Natural gasolines remained seasonally slow but steady and on June 20 grade 26–70 was quoted at 3–3⅛ cents per gallon (1.81 cents gold *) in Oklahoma; at 3 cents per gallon (1.77 cents gold *) in North Texas; and at 3¼ cents per gallon (1.92 cents gold *) in North Louisiana.

Kerosene prices lost about ¼ of a cent per gallon during the last month, but at the close of June price began firming up under the influence of better crop outlook and harvest season. On June 20 grade 41–43 w.w. was quoted at 3¾–3⅞ cents per gallon in Group 3, Oklahoma market; and at 5 cents per gallon (2.95 cents gold *) on the East Coast at Bayonne. Gulf Coast prices for export remained unchanged at 3⅞–4 cents per gallon (2.29 cents gold *) for 41–43 p.w. grade and at 4–4¼ cents per gallon (2.43 cents gold *) for 41–43 w.w. grade.

With state control of crude oil production continuing entirely effective in the Mid-Continent area higher prices for crude oil and its products will be warranted during this summer, though this improvement may be delayed until California comes in line with its crude oil production and prices, since otherwise shipments east from California would create too great a differential.

* U. S. Dollar at 41 percent discount.

Export Shipments Under 1934

DURING April, 1935, total gross imports of all petroleum products into the United States amounted to 4,450,000 bbl., 148,400 bbl. per day, as compared with 4,415,000 bbl., 142,600 bbl. per day, imported during the preceding month; out of this total during April, 1935, 2,770,000 bbl., 90,200 bbl. per day, were imported for domestic use and 1,743,000 bbl., 58,200 bbl. per day, were imported in transit either for refining and re-export or for use in vessels in foreign trade. During the preceding month, March of 1935, 2,725,000 bbl., 87,800 bbl. per day, were imported for domestic use and 1,690,000 bbl., 54,500 bbl. per day, were imported in bond as indicated above. The crude oil imported for refining and re-export amounted in April, 1935, to 629,000 bbl. Thus during April the net imports for domestic use continued within the federal recommendation of 108,400 bbl. per day.

Exports of all petroleum products during April, 1935, declined 15.15 percent below the daily rate of the preceding month, reaching 8,081,000 bbl., 269,000 bbl. per day, as compared with 9,845,000 bbl., 317,000 bbl. per day, shipped during March, 1935. The April, 1935, total exports were far below the shipments in April of 1934 when 11,566,000 bbl., 385,000 bbl. per day, were exported, thus showing a decline of 30.1 percent. Exports of crude oil from the United States during April, 1935, however, were above those for the preceding month amounting to 3,776,000 bbl., 125,000 bbl. per day, as compared with 3,281,000 bbl., 106,000 bbl. per day, shipped in March. In April of 1935 crude oil exports constituted 46.6 percent of the total exports of all petroleum products.

During the first four months of 1935 the exports of all petroleum products from United States amounted to 33,340,000 bbl., as compared with 36,473,000 bbl. exported during the same period of 1934, indicating a decline of 8.58 percent. The entire decline was in the refined products which dropped from 25,150,-

000 bbl. in 1934 to 21,110,000 bbl. in 1935, a decline of 16.05 percent, while crude oil exports increased from 11,323,000 bbl. in 1934 to 12,230,000 bbl. in 1935, an increase of 7.41 percent. Motor fuel exports declined from 9,228,000 bbl. during the first four months of 1934 to 7,434,000 bbl. for the same period of 1935, a decline of 19.32 percent. Thus it appears that the increased refining construction in Europe is more than taking care of the rapidly increasing motor fuel demand there, while the continued large exports of heavy oils from the United States may be attributed to accumulations of war storage reserves in the Far East and elsewhere.

Effect of Federal Proration Recommendations in Principal Oil Producing States

	Sept. 1933 to May 1935 Cumulative Overproduction		May, 1935 Over-production	June, 1935 Federal Daily Quota	Daily Average Production for Week ending	
	bbl.	% of total	bbl.	bbl.	June 8 bbl.	June 15 bbl.
Texas	37,565,000	55.5	535,000	1,059,300	1,053,000	1,046,000
Oklahoma	10,460,000	15.4	436,000	514,200	487,500	532,000
California	7,823,000	11.6	*	512,700	555,000	575,000
Kansas	2,697,000	4.0	58,000	154,300	142,000	149,000
United States	67,579,000	100.0	1,620,000	2,651,000	2,655,500	2,724,000

* California underproduced 100,000 bbl. in May.

Production and Runs to Stills

CRUDE OIL and natural gasoline production during May, 1935, averaged about 2,730,000 bbl. per day, practically unchanged from the preceding month when 2,721,000 bbl. per day were produced; and it was about 78,000 bbl. per day above crude oil and natural gasoline production in May of 1934, an increase of 2.94 percent. The May, 1935, average daily crude oil production exceeded the federal allowables by 52,200 bbl. per day, Texas overproducing 535,000 bbl., Oklahoma overproducing 436,000 bbl. and Kansas overproducing 58,000 bbl., while California underproduced 100,000 bbl. With the end of NRA at the close of May crude oil production remained within federal recommendations during the first half of June in Texas, Oklahoma and Kansas, but California averaged some 53,000 bbl. per day in excess of its quota. Of particular importance was production within the federal recommendations in Texas, definitely indicating effective state control.

The crude oil runs to stills during May, 1935, averaged about 2,567,000 bbl. per day, or some 65,000 bbl. per day below the runs to stills during the preceding month when 2,502,000 bbl. per day were refined.

Total stocks of all petroleum products declined during April, 1935, by 1,291,000 bbl. to a total of 569,538,000 bbl., indicating daily gross withdrawals of 43,000 bbl.

Record Domestic Motor Fuel Demand

INDICATED domestic demand for motor fuel during April, 1935, established an all-time record for that month, averaging 1,203,000 bbl. per day, a seasonal increase of 16.55 percent above the daily average during March, 1935, when 1,032,000 bbl. were consumed per day; the domestic demand during April, 1935, was 103,100 bbl. per day above the domestic motor fuel consumption in April of 1934, an increase of 9.38 percent; 200,900 bbl. per day above the domestic motor fuel consumption in April of 1933, a remarkable increase of 19.94 percent; and 64,400 bbl. per day above the domestic motor fuel consumption in April of 1931, the peak year before 1934, an increase of 5.65 percent. Thus 1935 indicated domestic motor fuel consumption will in all probability establish an all time record by a wide margin.

The NEW YORK TIMES weekly combined business index after dropping to around 82 during May, recovered to 83.5 in the week ending June 8, 1935, as compared with 83.0 in the week ending May 4, 1935. The index stood at 85.5 on June 1, 1934; at 77.0 on June 1, 1933; at 67.5 on June 1, 1932; and at 87.5 on June 1, 1931. As indicated elsewhere in this review the end of NRA has been the dominating influence in the United States during the past month, with the long-term outlook definitely most promising, while set-backs, if any, will probably be in the nature of temporary local disturbances. The oil industry may show a remarkable increase in consumption of its products during the coming Summer with greatly improved highways and greater vacation funds of the public.

The daily rate of exports of motor fuel averaged but 49,000 bbl. in April, 1935, 41.6 percent below the preceding month; 45.9 percent under the motor fuel exports in April of 1934; 54.8 percent below the exports in April of 1933; and 65.0 percent under the motor fuel exports in April of 1931.

On May 1, 1935, motor fuel stocks at refineries, plants, terminals and in transit amounted to 63,804,000 bbl., a decline of 1,753,000 bbl. as compared with stocks on hand on April 1, 1935, indicating that during April motor fuel demand exceeded supply by 58,300 bbl. per day.

Field Developments—Texas

DURING the past few months the East Texas field was gradually further outlined until at this time the producing area is estimated to cover 125,000 acres, or 195 square miles. A total of some 18,000 oil wells was completed in the field up to July 1, or an average of one well to 6.94 acres. The current daily allowable production is around 460,000 bbl., while overproduction does not exceed 15,000 to 20,000 bbl. per day. The reservoir pressure declined 4 lbs. during May and 18 lbs. in the last five months from January 1 to May 31, 1935, present pressure being 1,213 lbs. New locations and completions continued at near the 1935 peak of around 100 per week each.

In Ector County, in West Texas Permian Basin, Gulf Production Company No. 1 C. A. Goldsmith, in section 10, Block 44, T1S, T. & P. R. R. Survey, 5½ miles due southwest from Cowden field and near Odessa, apparently made an important discovery when it was brought in for 891 bbl. of 36.2 gravity oil with but slight sulfur content from 4,170 to 4,172 ft. in sandy limestone. The new discovery is on a very large solid block of some 20,000 acres owned by the Gulf. Phillips Petroleum Company contracted with the Pure Oil Company, which has under lease a block of 9 sections (5,760 acres) 1½ miles due east from No. 1 Goldsmith, for the immediate development of that acreage.

Gulf Production Company's No. 103 J. T. McElroy in Upton County, the deepest well ever drilled in the world, was drilled to 12,786 ft. at which depth it is now being abandoned.

New Mexico

THE Ohio Oil Company's No. 3 State-McDonald in section 16-T22S-R36E opened a new important field in eastern Lea County, three miles due south from Eunice field and 10 miles due north from Cooper field, when it was brought in for about 12,000 bbl. per day initially from 3,785 to 3,815 ft. in the regular Eunice limestone pay zone.

Oklahoma

THE northern extension of Oklahoma City field into the disputed residential section in the proven but probably greatly drained area proved to be, as was anticipated, highly disappointing to date. Three wells first to reach the Wilcox sand failed even to produce so far, with one well, Phillips Petroleum Company's No. 1 Kennedy in section 34-T12N-R3W, producing 34,000,000 cu. ft. of gas per day from 6,464 ft., while two other wells by Champlin Refining Company and Westgate Oil Company with total depths of 6,435 ft. and 6,499 ft. respectively failed to respond at all. Moreover new wells reaching the Wilcox sand horizon in the north extension showed a definite tendency to cave very badly suggesting that the area has been affected by drainage even to a greater degree than was thought.

One of the most important progressive steps was taken by the operators of the South Burbank field in Osage County which was unitized on June 1, 1935. This is the first instance of a large field being unitized subsequent to practically full development. The unitized area covers 2,400 acres, of which some 1,900 acres are considered proven and on which 65 wells are now producing. The unitized acreage will be produced as one property under supervision of a committee with the Carter Oil Company (S.O.N.J.), the largest interest holder, in charge. The unitization is expected greatly to reduce the operating expenses and to increase the ultimate recovery of the field. The ultimate recovery of the unitized acreage is estimated at about 26,600,000 bbl. or at an average of 13,950 bbl. per acre. Two companies, Sinclair-Prairie Oil and Champlin Refining, did not join the unitized plan, but since they hold only edge leases their adherence to the plan was not essential.

BASIL B. ZAVOICO

World Petroleum Abstracts

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Industry.

Dr. O. W. Wilcox

Petroleum Geology

Louisiana Volcanoes and Oil Accumulations.—H. D. Easton, in OIL AND GAS JOUR., vol. 33 (1935), No. 45, pp. 28–30; 43.

The geology of certain portions of northeastern Louisiana is characterized by igneous upthrusts that have formed traps for the accumulation of oil, much in the same manner as has resulted from the upward intrusion of salt domes in the Gulf coast region. The bearing of these volcanic intrusions on oil prospecting in this region is discussed.

Summary of the Occurrence of Petroleum, Natural Gas and Asphalt in Germany.—K. Feige in KALI, vol. 28 (1934), Nos. 15 to 19.

This is intended as a survey of present knowledge of petroleum geology in Germany. There are five distinct fields in which petroleum is being produced or is likely to be found; each of these fields is described in considerable detail.

Sedimentary-Petrographic Research in Petroleum Geology.—W. Georg Simon, in OEL UND KOHLE, vol. 11 (1935), No. 13, pp. 217–222.

This is a study of mineral associations as an aid in correlation studies of the tertiary formations of the North Sea Basin, with particular reference to Northwestern Germany, Holland and Belgium. These deposits, mostly sands and generally barren of fossils, have had different origins and are capable of division into zones, each characterized by certain predominant minerals. The character and relative quantities of these minerals enable the geologist to correlate a number of formations over a wide area.

Drilling

Multiple Well Drilling Under One Location.—Brad Mills, in OIL WEEKLY, vol. 77 (1935), No. 7, pp. 27–29.

The Barnsdall Oil Co. of California has successfully completed three producing wells under one location on tide lands, making a large saving in circumstances where foundations and approaches may cost more than $55,000. At the surface the wells are spaced two feet apart in an isoceles triangle; the slope of the holes is $1\frac{3}{4}$ to 2 degrees, and the accomplishment further establishes the value of directional drilling and elimination of expensive foundations in inaccessible places.

Collapsible Bit for Drilling Through Heaving Shale.—R. G. Hamaker and G. G. Harrington, in PETR. ENG., vol. 6 (1935), No. 7, pp. 64–65.

A review of drilling in one oil field of the Gulf Coast shows that eight blow-outs have occurred, in every instance while the drill pipe was being withdrawn; in another field there were 19 blow-outs, 12 while the drill pipe was being withdrawn, one when the drill pipe was out of the hole, and one where the drill pipe was being run in. It is evident that heaving shale comes into the drilled hole when the support of the drill pipe is withdrawn.

For meeting this condition there has been devised a new type of collapsible-blade drilling and coring bit so constructed that when the blades become dull the bit can be withdrawn from the hole without removing the drill stem. After refitting with sharp blades the bit, with blades in collapsed position, is simply dropped down inside the drill stem to the bit head, where the blades automatically expand to drilling position, and when the blades are again dulled the bit is withdrawn by running down wire with a specially designed overshot which unlocks the assembly for upward travel. For drilling through and for setting of casing through heaving shale the collapsible drilling bit is designed to operate through and on casing used as a drill stem; in this case the bit is designed with a large internal bore almost equal to the inside diameter of the casing used as a drill stem. Regular casing with regular couplings has been successfully used for this purpose. With these arrangements the pipe is never removed from the hole once the drilling bit encounters heaving shale. When the shale has been drilled through and a casing seat has been reached, the bit head is set as a casing shoe and cemented in place along with the pipe.

Handling High-Pressure Wells in the Gulf Coast.—K. C. Selater in PETR. ENG., vol. 6 (1935), No. 7, pp. 54–59.

In the oil fields of the Gulf Coast two conditions impose nearly insuperable difficulties on the operator. These are: the presence of relatively shallow sands carrying high-pressure gas in large volume, and the presence of so-called heaving shale. Each of these conditions has been responsible for many of the blow-outs that have characterized development operations in these fields, and have also called forth much effort and ingenuity in devising and using methods for controlling wells. The success of these methods is indicated by the fact that such incidents as blow-outs and wells getting out of control are becoming much less frequent.

The preventive measures employed include use of pressure drilling equipment and flush-joint drill pipe. Instead of 7-inch liners on the mud circulating returns two 3-inch lines are used, one with an adjustable choke. When a blow-out threatens, one 3-inch line is closed at once and the choke on the other used to build up a high pressure quickly. In some blow-out areas it is necessary to set three strings of casing. In heaving shale the quality and weight of the mud is important, and one or more blow-out preventers must be used, which must above all be dependable and quick acting so that a seal can be made in the shortest possible time when a blow-out threatens. As a further measure to assure quick action in emergencies, the drilling crew is given blow-out prevention drills to keep the equipment in working order and to familiarize the men with its operation. Trouble from heaving shale largely depends on the rate of drilling; time is required for high pressure to build up a sheath of mud on the wall of the hole. Drilling at ten feet per hour invites trouble; two feet an hour or fifty feet a day is more on the safe side. If the shale has a high dip, as in the vicinity of salt domes, it is better to employ directional drilling so as to enter the shale at a slight angle; there is then less tendency for the shale to heave; or the shale may be avoided entirely by directional drilling through the salt itself. Much of the future development in this field will entail deep drilling, and skill in handling high pressures will become increasingly important.

Accurate Well Logs.—L. G. Bignell in OIL AND GAS JOUR., vol. 43 (1935), No. 45, pp. 23–24.

Good logs of producing formations have not been the rule with holes completed by cable tools, because the driller does not recognize the necessity of saving all the sample, instead of the sand only. The result is a lack of definite information regarding the character of the formation and consequently it is difficult to determine the best methods of making repairs or to increase production. Coring is probably more common with rotary outfits than with cable tool drilled wells, but here also too frequently only the coarse portions of the sample is saved. A more satisfactory method is in use in the Fitts pool district, using well-head control and a system of high pressure separators while drilling into the producing formation. These separators permit all cuttings to be dropped as the flow from the well passes through it even down to 200-mesh sand, and samples can be selected at any time. By this method it has been possible to make an accurate chronological log of the section penetrated, so that by its use drillers familiar with the Fitts field first became aware of productive strata previously overlooked. This pressure control system of completing wells is particularly adapted to formations that stand well and do not cave.

Gel-Cement, its Use in Drilling Wells.—Wallace A. Sawdon, in PETROL. ENG., vol. 6 (1935), No. 7, pp. 29–31.

A gel-cement that will have a desirable consistency that will give it a high angle of repose can be made by addition of a specially treated bentonite to the cement slurry. Such a gel-cement (called Aquagel) has been found to stay in place without undue dissipation into extensive fissures, thus preventing or recovering lost circulation, and is useful for general and special jobs in the well. It was first used in the Barbers Hill field, Texas Gulf coast, where the cap rock was badly fissured and where neat cement would not mass up and stay where it was placed; in such cases the quantity of cement needed was reduced 50 percent. Although the mix is as thick as jelly it is self-lubricating to an extent that enables the pump to pick it up readily. The quantity of Aquagel to use depends on circumstances, but need not exceed 10 percent. It has been used success-

fully to seal off a gas-charged water sand in a well that required the use of weighted mud.

Colloidal Material in Native Drilling Muds.—M. T. Halbouty, in PETR. ENG., vol. 6 (1935), No. 7, p. 60.

The cost of present-day drilling muds, especially on the Gulf Coast, make it important for the petroleum engineer to take advantage of every desirable quality already present in the native mud to minimize these costs. It stands to reason that if a mud is made primarily from the colloids of a shale body, the mud thus formed will be well adapted for further penetration of that particular body. The engineer at the well should therefore study these colloids and build up a mud therefrom, increasing their dispersion and weight, if need be, by addition of peptizing agents. This paper is offered in the belief that too little attention is given to these native colloids.

Pressure-operated Blow-out Preventer.—K. C. Sclater, in PETR. ENG., vol. 6 (1935), No. 7, p. 62.

There is here described a pressure-operated blow-out preventer of improved design, developed as an answer to the difficult conditions of the Gulf Coast oil fields where blow-out hazards are more frequently encountered than in most other fields. The apparatus is constructed in view of the fact that a blow-out on a drilling well is very much like a fire; unless checked immediately it quickly gets beyond control and may result in loss and damage amounting to disaster. It is pressure-operated, with a lower valve to shut off the flow from drill pipe or tubing in the hole and an upper valve for shutting off flow through the casing, and may be operated by gas, steam or hydraulic pressure, or manually, either method of operation being adapted for remote control.

Oil Well Operation

Running Packers in Wells Under High Pressure.—H. C. Otis, in PETR. ENG., vol. 6 (1935), No. 7, pp. 42–44.

The development of equipment safely to run or pull packers under pressure, regardless of well volume of pressure, is altering the regard with which many operators view the use of packers. Until comparatively recently it was possible to run and pull packers only in wells of very small flow capacity or in wells that could be loaded during the running or pulling operations. Even when being run into very small wells, packers have been known to set prematurely and to be blown out of the well; and wells that have been loaded for the running operation have been known seriously to threaten to unload themselves before the packer had reached the desired depth; too, when the packer is employed to separate two producing horizons, and it is desired to be able to produce from either horizon, running the packer with the well loaded does not leave any way to unload between the casing and tubing to permit the horizon above the packer to produce.

Running packers under pressure, however, does away with the danger of the packer being prematurely set and blown from the well, and makes it possible to land the packer between two producing horizons without killing either. In addition it also removes the necessity for loading with mud or water—always an objectionable operation in a producing well.

During the past year a great many packers have been run under pressure in the West Texas field in wells ranging down to 8,800 feet in depth. The present article gives an interesting description of some of the special equipment used in this work.

Chemical Removal of Slimy Coating of Drill Holes.—H. C. Miller and G. B. Shea, in BUR. MINES RPT. OF INVESTIGATION No. 3249.

In rotary drilling with muds the walls of the hole in formations with weak formation pressures become coated with a slimy coating that seals off the flow of oil or gas. Various types of mechanical wall cleaners have been constructed and tried out, also washing out with oil or water and, in some cases gas has been used as a cleaning agent. All these devices have more or less limited use and effectiveness. As a further contribution to the art the authors suggest addition of a small amount of calcium carbonate (pulverized limestone) to the drilling mud. This will become incorporated with the wall coating, and when subsequently treated with hydrochloric acid the carbonate will be dissolved, with liberation of carbonic acid gas that disrupts the coating of slime. The effectiveness of this method was demonstrated by experiment. To protect the drilling equipment from corrosion by the acid any of the known inhibitors may be used

Natural Gas

Gas Storage as a part of the Operations of a Natural Gas System.—J. H. Dunn, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

What would it mean to the natural gas industry to find a way (1) to improve operating load factors; (2) to provide for a margin of safety during peak demands; and (3) to eliminate the waste of gas? The storage of gas in natural reservoirs does not offer a simple nor a complete solution of these problems, but it does offer a measure of relief with increasing possibilities. This question is answered by detailing the experience of the Lone Star Gas Company of Dallas.

As a general proposition a reservoir is suitable for gas storage if it has consistently produced gas according to Boyle's Law, properly applied. If any reservoir has produced gas satisfactorily on a normal decline from its initial pressure down to its present pressure, we may expect to be able to build up the pressure by injection, and again produce gas down to that same pressure, or lower, without loss due to liquid. On the other hand, if the liquid has been serious enough to have prevented the proper recovery of gas in the beginning, it probably will be serious enough to cause a loss if storage is attempted.

It is preferable to own all wells producing from the reservoir to be used for storage. It is desirable further to own all of the acreage involved which could be drilled into production. If the gas rights or royalty cannot be acquired at a reasonable cost, it may be possible to establish a rental basis or a reduced royalty basis. The incentive to the royalty owner to cooperate lies in the prolongation of the life of the field and hence for him a greater ultimate revenue. Gas reservoirs covering small areas are easier to control and may be considerably less expensive to acquire.

With reference to the justification of the cost of storage operations, we should keep in mind the fact that we are establishing increased known gas reserves at points on our system where we are prepared to utilize the future production without additional pipe lines and facilities. This fact will not only tend to reduce future capital expenditures but will also postpone the necessity for the abandonment of facilities which would otherwise be subject to early abandonment.

NOTE.—The operating and business principles set forth in this paper deserve serious consideration in view of the enormous waste of irreplaceable natural gas that is now going on in the Texas Panhandle.—ED.

Copper Pipe and the Corrosion Problem in City Plants.—E. A. Munyan, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

As a means of conquering the corrosion problem the author's company started experiments with copper tubing for gas services in Cincinnati. According to figures now available, for an average cost of 15 cents a foot extra for copper pipe and brass fittings over steel pipe and malleable fittings, or an average cost of $1.95, per service of 13 feet, the copper services can be laid in place of steel in Cincinnati. The average life of a steel service is 11¼ years; according to the laboratory tests a copper service should last 12 times as long, or 135 years in the same soils. There is now a copper tubing available that will elongate 52 percent, which is of advantage where there is likelihood of hill slides.

The Girbotol (Gas) Purification Process.—R. R. Battoms and W. R. Wood, in REFINER, vol. 14 (1935), No. 3, pp. 105–107.

In the patented Girbotol process, separation of hydrogen sulphide or carbon dioxide from gas mixtures is based on the fact that aliphatic amines at ordinary temperatures have a strong affinity for the named gases, whereas this affinity becomes rapidly less at higher temperatures, so that the absorbed gases may be expelled by heat. The reaction is therefore reversible and may be made into a continuous process. Amines suitable for the process are:

	Boiling point 0 C°.
Trimethanolamine	208 (10 mm).
Monoethanolamine	172
Dapol	119 (4 mm).
Methicol	217

Each of these amines are applicable to particular purposes. Being strong bases and freely soluble in water, large volumes of acid gas may be removed per volume of solution circulated.

The cycle and equipment employed in the process are almost identical with those used in a gasoline absorption plant. Amine solution at atmospheric temperature flows down through a bubble tower against a rising current of the gas to be treated. The purified gas issues from the top of the tower; the rich amine liquor, saturated with acid gas, goes through heat exchangers and enters a reactivator, also in the form of a bubble tower containing a reboiler at the bottom and a reflux condenser at the top. The amine solution enters the top of the reactivator at 215°–220° F. and the absorbed gases are expelled by steam arising from the reboiler. The cooled, reactivated solution passes back to the absorber. The expelled hydrogen sulphide gas may be burned under the furnace, or used to make free sulphur by the Claus process, or otherwise. Since hydrocarbons are not soluble in the solution, wet gas may be treated before extraction of the gasoline, thus saving the expense of a separate gasoline treatment.

The process is also being used for removing

carbon dioxide from industrial hydrogen that is produced by reacting steam with methane. In most instances the Girbotol process will remove the carbon dioxide more economically than will the ordinary wash process, as no compression is needed in the absorber, and the process may be carried out with relatively small amounts of solution.

Testing and Repairing Orifice Meters.—Russell M. Lilly, in REFINER, vol. 14 (1935), No. 4, pp. 195–196.

For cases where orifice meters get out of repair there is now a tendency to adopt what is termed a "quick-change interchangeable" meter installation. All such instruments are set up in exactly the same manner and in such a way that they are easily interchangeable with one another or with "spares", so that a defective meter can be taken out and a new one put in its place within five minutes. The use of such equipment encourages the periodical examination and overhaul of instruments. There is no longer need for making time consuming repairs and adjustments in subzero weather or in the scorching heat of summer; instead, repairs can be made at leisure in a comfortable shop.

Liquefied Gas (Propane and Butane) for Automotive Engines—Hopfer, in CHEM. ZTG., vol. 59 (1935), No. 29, pp. 298–299.

At the Leuna hydrogenation plant in Germany the waste gases are compressed by a turbo-compresser under about 20 atmospheres and fractionated to separate butane and propane. For use on the road a special container, weighing 42 kg. and containing 41 kg. butane or 34 kg. propane, has been devised. Some 500 power vehicles of the vicinity have been equipped so that they may each carry three or four of these containers, sufficient for a cruise of about 250 miles. According to present operating experience one kg. liquefied Leuna gas is equivalent to about 1.7 kg. ordinary gasoline.

Cathodic Protection of Pipe Lines from Soil Corrosion.—Scott Ewing in NATURAL GAS, vol. 16 (1935), No. 4, pp. 16–20.

This paper deals with the economics of giving buried pipe lines cathodic protection against soil corrosion. Cathodic protection may well be applied to a new line after the conductance of the coating has increased to an approximately steady value with the object of preventing any corrosion of the pipe where the coating is not effective. More frequently it is used on pipe lines that have begun to develop electrical leaks, with the object of delaying the time when reconditioning will be necessary. The savings that can be effected in this way are shown in figures.

There is also given a summary of methods that may be used in installing a system of cathodic protection, and the criteria by which the indications of the testing instruments are interpreted.

Improvements in Technique of Compressor Station Operation.—B. L. Rogers, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

The experience of automobile engineers, to whom the problem of compression is vital, has been of great assistance to designers and operators of gas compressing stations, particularly as regards valves and valve seat wear, valve cooling, cylinder and ring wear, bearing life and vibration and selection of lubricants. By following up these hints many plants have gone for several years without loss of a bearing or a foundation bolt, without the necessity of regrouting an engine or noticeable longitudinal vibration of foundation blocks. Piston ring fits of 0.002″ at all points are now standard, obviating "blow-bys" and securing perfect lubrication. In the matter of lubrication, an oil of viscosity ranging between 57 seconds and 75 seconds at 210 degrees, "flash" and "fire test" and "carbon content" being in line, can be depended upon to give 15,000 brake horsepower hours per gallon, when lubricating both power and compressor cylinders and power and compressor rods with lower maintenance expense than will result from more lavish use of oil. If above figures cannot be attained, the reason is to be found in some faulty mechanical condition, such as ring fit, ring clearance (either end or groove clearance) faulty alignment of piston or failure of force feed lubricator to deliver uniformly.

Having found that an oil suitable for cylinder lubrication was entirely unsuited for bearing lubrication as well as uneconomical, and that a good circulating oil could not properly lubricate the power cylinders and increased maintenance cost more than offset any saving due to lower price per gallon, the author ventures the following conclusion:

That an oil, in order to serve both purposes satisfactorily, would have to combine the characteristics of a 30 S.A.E. rating at 210° F., with those of a 10 S.A.E. rating at 100° F. No such oil was ever heard of until very recently. Oils having such a low viscosity index, so flat a temperature viscosity curve, have only recently been sponsored by research laboratories, and made commercially available, but at a premium price per gallon.

It has now become uniformly recognized that water having a hardness of more than three grains per gallon should be reduced by some means to less than that figure in order to keep the machinery scale-free.

Experience in Operating a Natural Gas Transmission Line.—A. L. Forbes, Jr., before Am. Gas Assoc., Nat. Gas Dept., Memphis, 1935.

This paper describes some experiences encountered in operating a high pressure natural gas transmission pipe line through West Texas, New Mexico and Arizona consisting of 715 miles of main lines of 16″ down to 4½″ diameter and pressures from 450 to 650 lbs. per square inch. The gas originates in Lea county, New Mexico, which is 650 miles from the furthermost point of consumption. The gas contains about 300 grains of hydrogen sulphide per 100 cu. ft. and cleaning this gas furnishes the company with most of its operating problems.

The sour gas is purified in two sets of scrubbing towers in series under a pressure of 450 lbs. with soda ash solution, which after saturation is reactivated either by aeration or heat. The pipe lines used to recirculate the soda ash are subject to less deterioration when heat is used for reactivation and the consumption of soda ash is 60 percent less. The maximum amount of gas treated in one day has been 47 million cu. ft., and no internal corrosion has been noted in the main line, which is frequently inspected. The hydrogen sulphide is kept down by the purification process to about 3 grains per 100 cu. ft. The gas as it enters the main line is saturated, but except for a short stretch near El Paso no freezing has been experienced; temporary relief was afforded by a main line drop about 10 miles from the point of freezing.

The measurement department had difficulty in making a recording-type calorimeter check with Junkers type calorimeter, the readings of the former being 1085 to 1090 B.t.u. and from the latter 1040 to 1070 B.t.u.; the most careful laboratory operators could not obtain a good check between the two instruments until it was decided to make all conditions so ideal that it would be unnecessary to apply correction factors shown in the U. S. Bureau of Standards tables. The chief of these conditions was found to be the relative humidity, which at El Paso in the summer is around 12 percent; by spraying water in the test room to create a relative humidity of 80–85 percent, and after developing a humidifier by which air passing to the burner of the Junkers calorimeter could be humidified to the same degree, the two instruments checked very closely. These humidifiers are now in use over the entire system, so that company and consumer testers get results that do not vary more than 5 B.t.u.

Another puzzle developed when gas dispatchers noticed discrepancies in pressures located on a 10¾″ line, some remote points showing higher pressures than others nearby; gauges were checked but the reports continued the same. The reason for these differences was finally attributed to differences in elevation; differences of 1300 to 1500 feet produced differences of as much as 26 lbs. on days of very low consumption, but would check within a pound or two when a factor was introduced into the Weymouth flow formula to allow for the weight of a column of gas whose height was equal to the difference in elevation. Various other interesting problems and their solutions are described in the paper.

Petroleum Refining

Refining Lubricating Oils with Furfural.—G. R. Bryant, R. E. Manly and B. Y. McCarty, before Am. Petrol. Inst., Tulsa, May, 1935.

This paper describes the operation and development of the furfural-refining process as applied commercially to the manufacture of high-quality lubricants from distillate stocks derived from Mid Continent pipe-line crude and ranging in viscosity between 40 sec. and 180 sec., Saybolt Universal, at 210 deg. F. The most recent design of a furfural-refining unit is described, and a flow diagram presented. Operations are considered from the standpoint of solvent losses, investment in equipment, operating costs, and product quality. Solvent losses have been 0.038 percent of the total solvent distilled in the commercial unit.

Direct operating costs have been approximately $0.1739 per barrel of charge to the furfural-refining unit. Investment costs vary between $70 per barrel of daily capacity for the 5,000-bbl. units to about $300 per barrel for a 500-bbl. plant. Lubricants manufactured by furfural refining have given excellent service performance, and have shown unusually high resistance to oxidation and sludging. Pilot-unit tests are shown illustrating the application of furfural refining to a variety of lubricating stocks.

Solvent Extraction of Petroleum Fractions.—M. L. Dickinson and J. T. Dickinson, before 5th Conf. Penn. Mineral Industries, State College, April, 1935.

According to the best available information there are now operating, building or authorized, a total of 22 solvent plants in oil refineries of the United States; the total rated charging capacities of these plants is about 45,000 bbl. per day; assuming 60 percent yields there will be in operation this year (1935) sufficient solvent capacity to finish 27,000 bbl. of lubricating oil per day. The total production of

lubricants in the U. S. in 1934 averaged 72,300 bbl. a day, of which 50,700 bbl. was consumed in this country, and it is estimated that 28,700 bbl. was used as motor lubricants, from which it would appear that the estimated production of solvent-treated lubricants about equals the requirement for motor oil consumption.

Among the solvents commercially used anhydrous phenol is used in four plants; this has the advantage over some other solvents in a low ratio of solvent to oil and greater improvement in color and carbon residue in producing oil of a given viscosity index. As recently used with addition of water to the extract before the latter is removed, yields are better than with most other solvents. Counter-current extraction is better than the batch system, and the most truly counter-current action is obtained in the conventional packed column, especially if arrangements are made to obtain something analogous to the reflux action in a bubble tower. An application of this idea in solvent refining is illustrated. High ultimate yields are thus possible. Aside from phenol, the use of propane as a selective solvent is discussed. The whole subject is treated with special reference to the refining of Pennsylvania oils.

Dewaxing with Acetone-Benzol. — W. A. Myers, in OIL AND GAS JOUR., vol. 33 (1935), No. 45, pp. 78–80.

The acetone-benzol method of dewaxing is used in the Philadelphia plant of the Atlantic Refining Co. The process consists in mixing the wax-bearing oil with the solvent, chilling the mixture and filtering; it is used on oils of the pressable wax distillate variety or on heavier oils which have heretofore been handled either by cold settling or by centrifugaling. Two solvent recovery units are employed, one for slack wax and one for dewaxed oil. The solvent consists of 25 to 35 parts of acetone and 75 to 65 parts of commercial benzol, which may contain 12 to 25 percent of totuol. As the solvent is a volatile and rather expensive material, the solvent recovery apparatus must be gas tight. A wide variety of charge stocks has been successfully treated.

Application of Oil Circulation to Ultimate Yield Fractionation.—J. A. Altschuler, in REFINER, vol. 14 (1935), No. 4, pp. 140–146.

The Stratford oil circulation system of oil heating as newly applied at the Lobitos refinery in England is described. The requirements imposed were to obtain maximum yields with "gaps" between products of 9° F. so as to be assured of maximum recovery of products for which there is the greatest demand and the highest price differential; to provide a topped crude as a charge to an attached high vacuum lube unit free of light compounds. The inside fired oil circulation heater was chosen as best suited for the case in hand. In order to provide the flexibility and closeness of fractionation required it is held that the Lobitos installation tends to show the practicability of multi-tower installations, each tower being equipped with a reboiler, thus solving a re-boiling problem that would be very complex with a conventional pipe still.

Other possible applications of oil circulation are cited as follows:

1. For the heating required in the separation of solvent materials from extract and rafinate of modern solvent treating processes, where two or more separate pipe stills are now required. One oil circulation system replaces multiple pipe stills at greatly reduced initial investment, and provides increased flexibility and ease of operation.

2. In two- or three-stage pressure-distillate rerun plants operating under high vacuum on the latter stages where maximum temperature of 260/300° F. must not be exceeded.

3. For the heating of lubricating oil distillates containing small quantities of finely divided clay to the optimum reaction temperature. In this case, the heating would be by indirect equipment designed to withstand erosion, thus eliminating frequent replacements of the tubes so common where tubular heaters are utilized for this service.

4. In grease manufacturing plants where heating means are required, and where high pressure steam is not available.

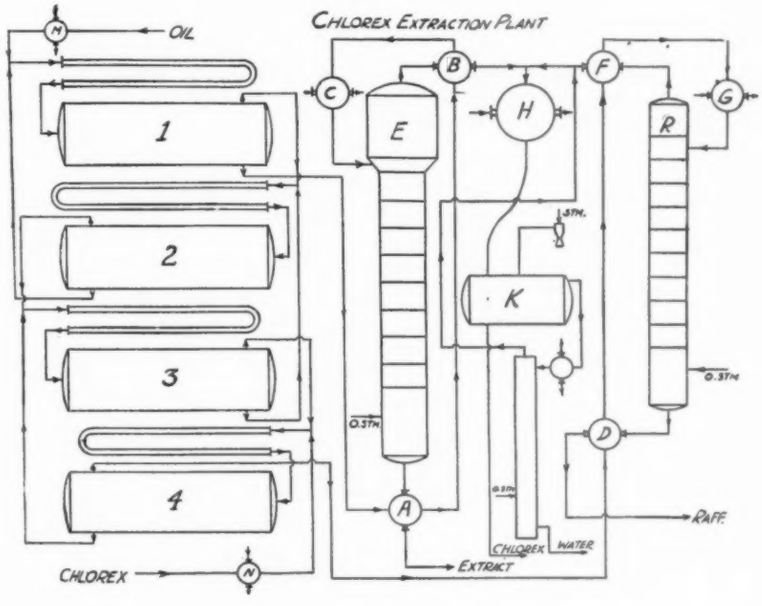
5. Reboiling by indirect heating in absorption plants particularly in remote locations when high pressure steam generating plants are not available, or expensive to install.

6. For the heating of lubricating oil distillates to dehydration temperature previous to chemical treatment.

Recent Developments in Solvent Extraction with Chlorex.—D. B. Williams, before Am. Petr. Inst., Tulsa, May, 1935.

There are now seven plants in operation for the selective solvent refining of lubricating oils, using Chlorex as the solvent. These plants, with their rated capacities are given as follows:

Plant	Daily Oil-charging Capacity (42-Gallon Barrels)
Standard Oil Co. (Ind.), Casper, Wyo.	600
Standard Oil Co. (Ind.), Wood River, Ill.	1,000
Mid Continent Petroleum Corp., Tulsa, Okla.	200
The Pennzoil Co., Oil City, Pa.	1,000
Socony-Vacuum Oil Co., Olean, N. Y.	1,700
Freedom Oil Works Co., Freedom, Pa.	1,200
Bradford Penn Refining Corp., Clarendon, Pa.	450
Total	6,150



Descriptions of these plants with typical results from treatment of Pennslyvania crudes are given. The general lay-out of a chlorex extraction plant is shown in the accompanying diagram. In general, extraction is effected on the counter-current principle in horizontal tanks, one above the other. Four stages are generally sufficient for Pennslyvania crudes; Mid-Continent and Coastals may require up to seven. Typical examples are given to show comparative costs and quality of product obtained from various crudes.

Spent Doctor as a Research Problem. —Kenneth S. Valentine and Gordon MacLean in REFINER, vol. 14 (1935), No. 4, pp. 155–157.

Recovery of the values contained in spent doctor solution is recommended as a fit subject for study in every refinery; between the lead lost to the sewer, the oil evaporated off and the final throwing out of the caustic, there is enough money going to waste to pay for all the labor of the treaters where sweetening is important. Even refineries having what is considered a good doctor-rejuvenating system are spending hundreds of dollars a month for makeup lead. Recovery of the emulsified oil from spent doctor is also worth while, if a way to break the emulsion (blackstrap) is found. One large refinery is doing it by centrifugaling, but there may be a simpler way for some one to discover. Reoxidation of the lead sulphides also offers a promising field for plant research. The authors conclude with the remark that if as much work had been put on doctor sweetening as on the effort to supercede it, the problem would have been solved long ago.

Separator-Nobel Heavy Solvent Process of Dewaxing.—Anon. in REFINER, vol. 14 (1935), No. 4, pp. 147–152.

A particularized description, released by the Aktiebolaget Separator-Nobel, is given of the centrifugal dewaxing process for dewaxing oils developed by that concern. In essence the process consists of diluting the crude lube stock with a heavy solvent which dissolves oil but precipitates wax. The semi-solid wax, being lighter than the solution, tends to float on the surface and can easily and continuously be separated by means of a centrifugal machine acting on the principle of a cream separator.

Among the many chlorinated compounds tried out by the Separator-Nobel A.-B., trichlorethylene has proved suitable for most kinds of oil; it boils at 188° F. and has a specific gravity of 1476 at 60° F. It dissolves asphaltic bodies present in the oil, transforming them into a non-inhibitor state, so that even asphaltic residues can be dewaxed without previous detarring; the solvent can be distilled off with steam below 265° F. without danger of corroding the apparatus. The dewaxing centrifugal is of special construction

and has a capacity of 50 to 120 bbl. of oil per 24 hours, depending on wax content and viscosity of the stock. The proportion of trichlorethylene to oil varies from 40 to 60 percent. Solvent loss should not exceed 0.3–0.4 percent. It is assumed that a 500-bbl. per day plant will cost about $150,000 and that the cost of treatment will be about $1.00 to $1.50 per 100 U. S. gallons. A plant of average size can be operated by a crew of three men. The yield of dewaxed oil varies from 80 to 97 percent.

SPECIAL STEELS FOR HYDROGENATION AND REFINING PLANTS.—A. Fry, in PETROLEUM ZTSCHR., vol. 31 (1935), No. 14, p. 15.

There are now available special steels, mostly containing small amounts of molybdenum, chromium, silicon or aluminum suitable for the construction of steam boilers carrying pressures of 230 atmospheres and steam temperatures of about 550° C. (958° F.), corresponding to a low red heat. These steels have high heat resistance and tensile strength, and are well adapted for the construction of superheaters. Large containers for hydrogen in air-ammonia and oil hydrogenation plants have to stand pressures over 200 atmospheres and temperatures above 400° C.; under these circumstances ordinary iron would be rapidly destroyed by the hydrogen, but by means of the above-mentioned additions the new steels resist attack by hydrogen even at 600° C. These hydrogen-resistant steels are also finding use in the cracking tubes of gasoline plants.

TRENDS IN CHEMICAL REFINING PRACTICE.—Carl W. Berger in REFINER, vol. 14 (1935), No. 3, pp. 111–113.

This is a very readable summary of a great number of refinery practices that are in a state of modification and improvement, particularly as regards removal of hydrogen sulphide from refinery products. One interesting conclusion is that if straight run and cracked gasolines are doctored separately, the same doctor solution should not be used indiscriminately on the two products, else the straight run product will be surprisingly fouled. Another is the success of the Hoover process by which distillates are sweetened without recourse to caustic agents. This process is a dry contact treatment using copper chloride as active agent, and is unique in that it does not affect any hydrocarbons other than mercaptans, which are oxidized to "sweet" compounds.

TECHNICAL CONTROL OF PERCOLATION FILTRATION.—S. R. Funsten and H. L. King, Jr., in REFINER, vol. 14 (1935), No. 3, pp. 108–110; No. 4, pp. 167–170.

Recent publications on petroleum refining by various methods of solvent treating frequently have referred to attractive savings in manufacturing costs through elimination or reduction in use of clay. Such claims are particularly impressive to those refiners whose present treating processes are excessive in cost through lack of technical control and uneconomical balance of refining methods. Thus, while it may be physically possible to use large volumes of solvent to produce a finished oil in one step by solvent refining, the accompanying low yield of treated oil and excessive processing cost would probably make the addition of a clay refining step justified from an economic standpoint alone. The authors, who are connected with the Attapulgas Clay Company, point out that clay treatment by percolation filtration often has as its primary function the improvement of stability, demulsibility, sludging characteristics, cast or bloom, dielectric strength and odor and taste of the oil. When this is the case the advantages of percolation filtration should not be overlooked.

As a help to the refiner who desires to avail himself of these advantages the authors lucidly outline a system of technical control of the clay station so that maximum efficiency and economy may be attained.

Asphalt and Tar

THE GARD-ALDRIDGE ASPHALT PROCESS.—R. T. Howes and C. N. Whitaker in REFINER, vol. 14 (1935), No. 3, pp. 102–104.

The Gard-Aldridge asphalt process, as described, consists essentially in mixing intimately asphaltic residium as flux with air at a suitable temperature. This intimate mixture is obtained by circulating mechanically a large volume of stock with an economical amount of air. Agitation is provided by a vertical low head pump which takes the stock from one end of the still and discharges it at the other, thus establishing circulation of the material within the vessel around the cooling coils, eliminating dead areas, obtaining maximum heat exchange, and shortening the time required for oxidation by the air introduced into the pump duct. It is the use of this circulating device that mainly distinguishes this process from the conventional method of manufacturing oxidized asphalt. The product of an 8½-hour run tested as follows:

Melting point		291° F.
Penetration	at 32° F.	26
Penetration	at 77° F.	28
Penetration	at 115° F.	31
Ductility		1
COC Flash		475° F.
PM Flash		450° F.
Soluble CS_2		99.71%
Soluble CCl_4		99.71%
Soluble 86° Naphtha		68.00%
Fixed Carbon		15.00%

The unusual features of this oxidized product will be apparent, particularly the penetration tests between 32° and 115° F., the solubility taken in connection with the melting point, and the ductility. The circulation feature of the process makes it adaptable for adding fillers and making blends for other than standard specification products.

THE STRUCTURE OF COLD ASPHALT.—E. H. Kadmer, in ASPHALT UND TEER, vol. 35 (1935), No. 9, pp. 167–170.

Cold asphalt is asphalt in a state of emulsion such that it is a flowable liquid, so that it can be used in road construction without having to be melted on the job. For making such emulsions asphalt of California or Mexican origin is preferred in Europe to Roumanian asphalt.

The emulsifying agent is, in the first place, water, and the emulsion is produced by an intensive mechanical mixing of the asphalt with the water. However, simple water emulsions are unstable, hence it is necessary to use an emulsifier to produce a stable emulsion. If the asphalt naturally contains organic acid (pitch-resins), addition of alkali will form a soap that acts as emulsifying agent, or a ready-made soap may be used. A favorite recipe is to heat the asphalt up to about 100° C., and add about 2 percent of its weight of some organic acid waste product, as naphthenic acids, waste tallow, soap stock, etc. In a separate kettle the calculated amount of alkali and water are heated to 90° C., the contents of the two kettles are run together and intimately mixed by violent stirring.

The use of solid alkalies, such as caustic soda, has certain objectionable features, which are avoided by the use of emulsifers with a volatile alkali base, such as triethanolamine, put out by the IGF. Another new one is ammonium linoleate, which is a first rate emulsifier and when spread on the road rapidly loses its ammonia, leaving no salty residue. These new organic emulsifiers are more expensive than the old-fashioned ones, but for first-quality work their use appears justifiable (see following abstract).

STRUCTURE AND PREPARATION OF COLD ASPHALTS.—E. H. Kadmer, in OEL UND KOHLE, vol. 11 (1935), No. 13, pp. 225–229.

This is a more extensive discussion of the theory of cold asphalts and the use of emulsifiers and stabilizers (compare preceding abstract).

Pipe Lines

CORROSION PROBLEMS IN A CITY PLANT.—Charles F. Turner, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

The author emphasizes the importance of following a logical procedure in abating the ravages of corrosion and of engineering intelligently all phases of a protection program whatever that program may be. This should include surveys not only of soil characteristics but of electrolysis conditions and the keeping of accurate records of pipe failures. These records need not be elaborate and costly but they should be specific, showing the kind of pipe, its age, whether it was coated or bare, whether the couplings were insulating, the type and resistivity of the soil, the magnitude of stray currents and their flow, and other pertinent information. We cannot stress too strongly the value of information of this kind. After a system of record keeping has been initiated it is possible to begin a corrosion map which, as time goes on, will outline the areas where special effort should be made to reduce failures. These records very often serve as a guide in determining where coatings should be used and where they should not be used, where it seems expedient to recondition and where it seems best to renew the pipe.

SUGGESTIONS FOR MAKING AND USING A PIPE LINE CORROSION SURVEY.—Scott Ewing, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

The application of a proper protective coating to pipe lines laid in corrosive soils will reduce the annual maintenance costs. In this paper the author gives a procedure for examination of the soil where coatings should be used. By this method the soil types are mapped and the soils are tested for total acidity and electrical resistivity. A method is also given for making a selection among the available coating materials, and for deciding on which parts of the line a particular coating will be most suitable. The average engineer is not usually confident of his ability as a soil expert, but he can generally get advice from his state agricultural experiment station for the asking, and with a little instruction and a few days experience any one should be able to

recognize and map the different kinds of soil along a pipe line, and where to take samples for examination by simple and expeditious methods in the laboratory. Calculations of corrosivity based on reaction (pH) alone are insufficient; the electrical resistivity must also be taken into consideration. These two data may be combined in a formula by which corrosion may be estimated for each soil type; this done, it will be possible to make an intelligent decision as to where coatings are necessary and what kind to use. The author emphasizes throughout the economic aspects of coatings, and the necessity of measuring expected savings against costs.

CEMENT PROTECTION OF PIPE LINES.—C. H. Bann, Jr., before Am. Petrol. Inst., Dallas, 1934.

Experience of the Standard Oil Co. of N. J. with cement mortar protection of nine 8-inch pipe lines each about 12 miles long over land and tidal flats has led to the following conclusions:

(1) Cement mortar protection is not entirely satisfactory where it is exposed to the action of salt water. A life of at least ten years can, however, be counted upon when the mortar is properly applied.

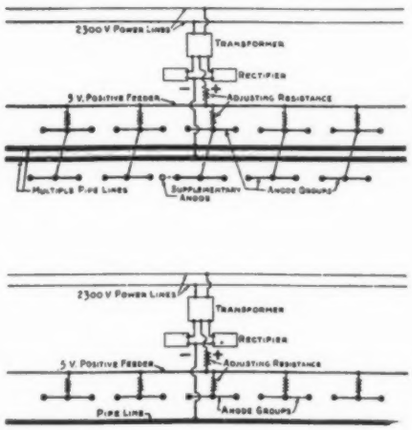
(2) Where cement mortar is applied in forms, spacer blocks made of cement should be used, together with some type of reinforcing, which should be at least the equivalent of the stirrups herein described.

(3) Apart from the action of salt water, cement mortar can be expected to render almost perfect protection if good workmanship and careful supervision are given to the whole job, the most important point being careful tamping of the mortar beneath the pipe to eliminate all voids. Proper mixing and curing are essential features common to this, as well as all other, cement mortar or concrete work. In this connection it is interesting to note that certain observers have stated that it is impossible properly to cure a cement mortar coating on a pipe line while the line continues in operation. This is, of course, attributed to the vibration of the line, but, unfortunately, sufficient evidence is not available to state whether the use of the line during the curing period is really a factor of importance or not.

CATHODIC PROTECTION OR ELECTRIC DRAINAGE OF BARE PIPE LINES.—Geo. I. Rhodes, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

It is commonly believed that the cathodic protection of bare pipe lines is impracticable. The entire absence of coating resistance would seem to indicate the requirement of excessive electric currents or at least the probability of being unable to control such currents as might be required. Reported applications of cathodic protection have been made on lines requiring not over ½ ampere per mile per inch in pipe diameter with 0.3 volt between pipe and soil. The indicated coating resistance exceeded 800 ohms per square foot. Some published observations with lines of obviously lower coating resistance led to the belief that the protection of a bare pipe line cannot be seriously considered.

However, extensive experience with an 80-mile line in Louisiana showed that electric drainage of pipe lines will practically eliminate the development of further leaks in a line so badly corroded that it would otherwise require reconditioning. This method of cathodic protection, or electric drainage, utilizes a principle of anodic location that is the object of U. S. Patent No. 1,962,696 of June 12, 1934, granted to Geo. I. Rhodes and assigned to Ford, Bacon and Davis, Inc. In this method, anodes of coke or other suitable material are buried at intervals along the line and connected to a parallel electric power line. The soil potentials thus created cause cathodic currents to drain away from the pipe. The general arrangement of anodes and power line to a multiple or single pipe line are indicated in the accompanying diagram. It is said that such a system can be installed at a fraction of the cost of reconditioning the pipe line, whether the line be coated and requiring relatively small currents per mile, or a bare line requiring maximum currents.



Where power is not available cathodic protection can probably be provided by the use of properly located zinc anodes short circuited to the pipe at a cost which on small lines with small current requirements compares favorably with protection by the use of power and which even on large bare lines can probably be provided at a cost far less than the cost of reconditioning.

Petroleum Physics

THE HANGING-DROP VISCOSIMETER.—L. Ubbelohde, in OEL UND KOHLE, vol. 11 (1935), No. 9, pp. 145–150.

The hanging-drop viscosimeter is described as the simplest and most accurate of the capillary viscosimeters, and can be used with no other corrections than the small ones for streaming-energy and surface tension. When the viscosimeter is calibrated with a mineral oil these corrections can be neglected when testing such oils. The newer form of the hanging-drop viscosimeter is described and directions are given for its manipulation.

VISCOSITY CHARACTERISTIC DERIVED FROM VISCOSITY AND GRAVITY.—W. J. Albersheim and H. S. Konheim, in NATL. PETROL. NEWS, vol. 27 (1935), No. 15, pp. 38–39.

The authors have made a further refinement in the viscosity-temperature chart as revised by Albersheim, Konheim and Larson which admits of a graphic determination of the viscosity characteristic of an oil from the specific gravity or A.P.I. number and viscosity at the same or different temperatures. The present article relates to the gravity scale and its mathematical development by the authors. By this means a viscosity-temperature chart may be constructed having the advantage over the standard A.S.T.M. chart that the characteristic of any oil at all temperatures can be drawn as a straight line.

Petroleum Chemistry

LABORATORY DISTILLING APPARATUS.—W. W. Scheumann and J. F. Stewart, before Am. Petrol. Inst., Tulsa, May, 1935.

Methods and apparatus are described for the laboratory evaluation of crude petroleum. The apparatus consists of the following four separate distillation units:

1. Atmospheric distillation unit
2. Stabilizing unit
3. Flash vacuum distillation unit
4. Vacuum fractionating unit

Operating data and characteristics of the products are given which illustrate the flexibility of the apparatus, and indicate the degree of fractional separation made.

A major advantage of the equipment consists of its ability to make sharp-cut fractions of sufficient size that they can be further refined to finished products in amounts sufficient for a determination of their quality.

MEASURING RESISTANCE OF OIL TO FORM SLUDGES.—M. Fairlie, in OIL AND GAS JOUR., vol. 33 (1935), No. 45, pp. 58–60.

An examination of oxidation tests on lubricating oils in available standard apparatus of various types showed that all had certain weaknesses, such as inability to differentiate sharply enough between relatively unstable oils; precipitation of tar that makes sampling and analysis difficult, disproportionate severity on light oils and insufficient severity on very unstable oils. A general criticism of such methods is that they do not duplicate actual conditions in the engine. The conditions in a typical modern engine are these: with the ventilation system in operation the atmosphere in the crankcase had substantially the atmospheric oxygen content, with ventilation suspended but with breather open the oxygen averaged 12 percent, the running crankcase temperature ranged from 200° F., to 300° F.; bearing temperatures up to 400° F.; piston temperatures 450° F. up to 700° F.; in addition there is contact with iron and other metals that may act as catylists.

To duplicate these conditions the author devised an apparatus consisting essentially of an electrically heated coil and a pump by which the oil could be circulated through the coil. The oil is pumped up to a header tank from which it drops by gravity to a sump, from which it is taken by the pump for recirculation. The outfit is provided with an automatic device for maintaining the oil at given temperatures, which are 425° F. heater outlet temperature; 220° F. sump temperature, with the oil circulating through the heater at the rate of 300 cc. per minute. The system contains four liters of oil which are weighed into the sump. The unit will run indefinitely with a temperature variation not exceeding 1° F. The test normally runs for 150 hours, samples being taken at 50, 100, 125 and 150 hours and tests made for tar and viscosity. The time required to form one percent of tar is noted.

Results of the tests were correlated with results of 17 cars using the same oils. It was found that the characteristics of the oxidized oils in the laboratory and in the cars compared closely, 75 hours in the laboratory being approximately equivalent to 1000 miles of

city driving. For further comparison laboratory engine tests were made. Under mild conditions of 180° F. jacket temperature serious ring sticking occurs at 5 percent tar, at 212° F. sticking begins at 1 percent tar, and at 0.5 percent at 250° F. jacket temperature. As 212° F. is the usual jacket temperature, a tar content of 1 percent is taken as the end of the useful life of an oil, 75 hours in the test apparatus corresponding to 1000 miles. Almost all the characteristics of a typical used oil are shown by the oil from the laboratory unit: tar, viscosity, Conradson carbon and acidity. Road driving does not exactly parallel city driving; light oils develop less tar than the laboratory tests indicated, because of lower operating temperatures.

The laboratory tests are capable of close duplication and are able to pick out slight differences in methods of treating oils and can differentiate finely between stable and unstable oils. The test has been adopted by the Sinclair Refining Co. for calibrating the stability of lubricating oils.

Polymerization Under High Pressure.—H. W. Starkweather, in JOUR. AM. CHEM. SOC., vol. 56 (1934), p. 1870.

Experiments were made with various organic substances in a study of polymerization under pressure. A cracked gasoline was subjected to a pressure of 9000 atmospheres (about 135,000 lbs. per square inch) for 48 hours at 60° C. No formation of gum was observed, but about 10 percent of the lighter constituents were transformed into higher boiling compounds.

Chemical Constitution of the Gasoline Fraction of Petroleum—A. P. I. Research Project 6.—Frederick D. Rossini, before Am. Petrol. Inst., Tulsa, May, 1935.

The work of the Institute's Fundamental Research Project 6 on the naphtha fraction of the crude petroleum which has been under investigation has reached the stage where it is possible to analyze critically, and with profit, the results obtained to date. The project has determined the chemical constitution of the major part of that fraction of a Mid Continent petroleum normally boiling below 180 deg. C. There have been actually identified and isolated 35 hydrocarbons; 6 other hydrocarbons have been detected and are in process of separation; and some 20 others are suspected to be present in significant amounts, and are in order for future investigation.

The future work of the project with regard to the naphtha fraction will be: 1, to complete the separation and identification of the as yet undetermined constituents; and, 2, to outline a general systematic method for separating the naphtha fraction of any crude petroleum into its major hydrocarbon constituents.

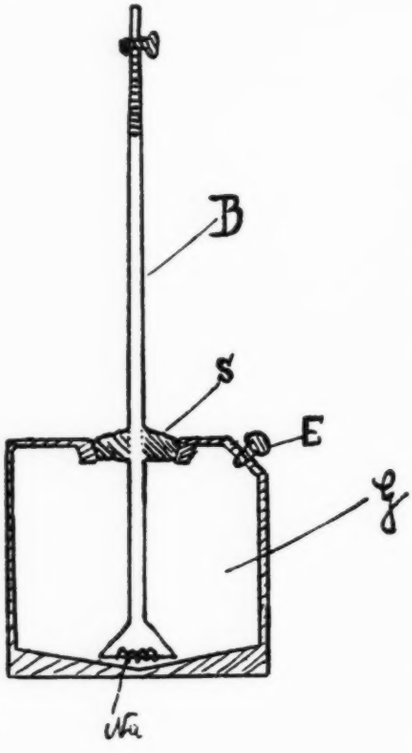
Distilling Apparatus for Testing Heavy Oils.—O. C. Blade, in OIL AND GAS JOUR., vol. 33 (1935), No. 45, pp. 25; 133.

Under the conditions of the Bureau of Mines Hempel distilling test by which heavy oils are analyzed by distilling under reduced pressure, it is not possible to carry the fractionation to an extent that is desirable, because this apparatus tends to develop leaks through the turntable stuffing box when the pressure is reduced below 40 mm. of mercury. A new apparatus has been devised to obviate this objection; the main new feature is that there is no stuffing box. The circular rack within the receiver, which contains 10 tubes for receiving the different fractions is rotated by an electromagnet and a system of ratchets; wires from the magnet lead to a switch and storage battery outside the receiver.

By this device it is possible to lower the pressure to one mm. of mercury. Distillation at this pressure is valuable in that more oil is recovered as distillate. In cases dealt with, distillation at 1 mm. pressure disclosed the presence of 40 percent viscous lubricating oil compared to around 4 percent at 40 mm. This enables the refiner the better to judge the value of the crude oil, as he gets a more complete picture of its constituents.

Water Content of Gasoline.—Maxmillian Cords, in CHEM. ZTG., vol. 59 (1935), No. 28, p. 288.

Traces of water in gasoline are accurately determined by the use of the simple apparatus shown in the annexed drawing. A glass burrette B, with a funnel shaped mouth and a cast-on ground glass stopper S, is inverted so as to close tightly the glass vessel G. A piece of clean sodium wire is placed under the funnel, some water-free gasoline is introduced through the glass-stoppered opening E and suction is applied so as to fill the burette with it. Then a measured quantity of the gasoline under examination is introduced. The sodium at once begins to decompose the water, and the liberated hydrogen will serve as a measure of the water present.



Petroleum Uses

Water-proof Cement from Spent Refinery Clay.—A. R. Chanler, in NATL. PETROL. NEWS, vol. 27 (1935), No. 15, pp. 32–35.

The author discusses the Evans process for the production of a plastic water-proof cement by grinding Portland cement clinker with certain proportions of spent refinery clay. The best clays for the purpose are those that have been used for the percolation-filtration of lubricating oils; those used in the treatment of gasoline are less suitable. The reason for this difference is that the clays from the lube plants contain a higher percentage of adsorbed petroleum products taken out of the oil, and it is these petroleum products that give the cement the desired properties. The spent clay is added to the clinker, before grinding, in the proportion of about three percent by weight. The resultant product is a plastic water-proof cement of excellent quality both as to strength, plasticity and waterproofing. The product is said to be finding extensive use on the Pacific Coast.

Sludge Formation in Mineral Oils.—E. Vellinger and G. Muller, in COMPTES RENDUS, vol. 198 (1934), p. 2252.

The quality of a transformer oil is generally tested by heating in the presence of metallic copper to 110° C. and determining the amount of sludge formed which is taken as a measure of the oil's resistance to oxidation. The author's researches confirm the fact that the formation of sludge in transformer oils is proportional to the time of heating and the quantity of copper that dissolves in the oil.

Petroleum Substitutes

Gas Production in Automotive Gas Generators.—J. Gwosdz, in OEL UND KOHLE, vol. 11 (1935), No. 7, pp. 109–116; No. 9, pp. 152–155.

Since gas generators attached to automotive vehicles afford a means of utilizing cheap domestic materials instead of expensive imported petroleum products, this method of producing power has lately attracted much attention in Germany. In this paper the author reviews the technical development of these portable gas generators since the war period; the constructive features of the principal types are described and illustrated by drawings. The principal difficulties encountered by designers have been the construction of a durable firebox that would stand service on rough roads, and the matter of removing tar from the gas or preventing its formation. These problems have been more or less satisfactorily solved in the latest designs.

Synthesis of Motor Fuels and Lubricants from Carbon Monoxide and Hydrogen—Franz Fischer, in OEL U. KOHLE, vol. 11 (1935), No. 7, pp. 120–123.

This paper is a summary of the highly important investigations on the synthesis of petroleum products that have been carried on since 1925 at the Mulheim-Ruhr Institute. These investigations are motivated, first, by the fact that Germany lacks natural petroleum deposits sufficient to supply the needs of the country, and secondly by the existing difficulties with foreign exchange which is driving the Germans more and more toward self-sufficiency, or what is called "autarchy."

As a basis of the synthesis of petroleum products any solid carbonaceous material will do if it can be made to yield a "water gas" in which the ratio of carbon monoxide to hydrogen is 1:2 (in ordinary water gas the ratio is 1:1). The desired ratio can be secured by

regulating suitably the temperature in the gasifying process and employing an excess of steam. In this way coal may be completely utilized, first by ordinary destructive distillation to produce gas and coal tar (which are already much used products) and coke, which in the ordinary operation of gas plants would be produced in excess. It is this excess of coke by which the Germans hope to make themselves independent, at least in part, of imported petroleum.

Having obtained (in any convenient manner) a suitable mixture of carbon monoxide and hydrogen the gas is led through heated tubes containing catalyzers of nickel, cobalt or iron, at temperatures ranging from 180° to 250° C., depending on the catalyzer; catalyzers of mixed metals are better than any metal taken singly, but excellent catalyzers may be obtained by making alloys of nickel or cobalt with silicon and removing the silicon with caustic soda, which leaves the metal in a finely porous condition.

The primary product of the synthesis is a mixture of liquid hydrocarbons which is called "kogasin" (from coal-gas-benzin); it is water-white, completely free from sulphur and consists of hydrocarbons of the aliphatic series, mostly straight chains; a little solid and a little gaseous hydro-carbons are also formed. The fraction boiling up to 200° C. is used directly as motor fuel under the name Kogasin I. The higher boiling fraction, called Kogasin II, is freed from paraffin and finds use as an excellent Diesel fuel. In the catalyzer chamber there is formed a paraffin that when purified, has a melting point of 120° C.

Aside from its direct uses, kogasin has proved a valuable raw material for the synthesis of high grade lubricating oils, higher alcohols, and a whole series of other organic products. The synthetic lubricants exhibit extraordinary resistance to oxidation (Sligh test zero), very low carbon residue, and very great cold resistance.

On the basis of the findings of the Mulheim Institute the Ruhr-Chemie A.G. has put up a large pilot plant, in which the process is now in actual production.

Petroleum Economics

Modern Methods of Meeting Competition.—H. G. Bonner, before Am. Gas Assoc., Nat. Gas Dept., Memphis, May, 1935.

This paper is an outline and a warning; the outline details the merchandising systems of a gas company exposed to competition from cheap coal and rising competition from electricity. By way of warning to the gas industry reference is made to development work of the General Electric Co. whereby electricity at 1 cent per kilowatt hour may become real competition with natural gas. This possibility is viewed as a clear call to the gas industry to support large scale research in the economical use of gas; manufacturers of gas using appliances cannot be expected to do this research alone.

Use of Bonus Formulas in the Refining Industry.—Gino G. L. Paganini, in Petroleum Zeit., vol. 31 (1935), No. 13, pp. 1–3.

Bonus formulas with profit sharing for employees, such as are employed in many industries as a stimulus to good work, are difficult to apply in such a highly automatized industry as petroleum refining, because it is difficult to determine the individual workman's share in the general result. The formulas of Taylor, Kendall, Rowan and others can hardly apply to this industry, because they are based on measuring quantity produced, or rate of turnover. But turnover in the refining industry is not the best measure of efficiency, but rather the excellence with which purely technical functions have been discharged, such as control of pressures and temperatures and other factors that determine quality of product. Therefore stimulants to emulation in efficiency in an oil refinery should be independent of time and quantity measurements and be largely based on quality and uniformity of performance. The author, who is an official of the new French refinery at L'Avera, has worked out a formula by which the performance of men at different stations can be measured and suitably rewarded.

Progress in Petroleum Industries in 1934.—Richard Kissling, in Chem. Zeit., vol. 59 (1935), No. 26, pp. 267–270.

This is a succinct summary of what may be considered to be the more important developments in practical and scientific petroleum technology. The article contains a list of books on petroleum that appeared during the year and a bibliography of 77 important articles and patents.

Drilling Prospects, 1935–1940.—W. V. Gross, in Oil Weekly, vol. 77 (1935), No. 1, pp. 21–23; 201.

On the basis of detailed studies of more than 600 oil and gas producing and prospective areas throughout the world, the author concludes that, barring the commercial production of any natural or synthetic substitute for gasoline in quantities sufficient to meet the world's needs, the next five years will witness an extremely intensive search for petroleum reserves. The opinion is also expressed that oil producers can, on the whole, expect better prices than they are now obtaining. The anticipated increase in exploratory drilling must be accompanied by an increase in refinery capacity outside the United States, and there will be more or less shifting of refinery centers. There are numerous definite indications that a substantial increased demand for petroleum and its products is in prospect. Except the Conroe pool, no market factor area has been brought in within the United States for three years, and only two in the rest of the world: the Poza Rica field in Mexico and the Buscani field in Roumania. It is expected that exploratory activity will be especially marked in Venezuela and Russia.

Common Carrier Operations and Natural Gas Pipe Lines.—Ed C. Connor and P. McDonald Biddison, in Natural Gas, vol. 16 (1935), No. 4, pp. 3–8.

The function of a natural gas pipe line as a means of transporting a daily supply of indispensable fuel to a multitude of individual consumers is not reconcilable with a requirement that the same pipe line serve as a common carrier for gas that is indiscriminately offered by any and all producers. This distinction is emphasized in view of imminent legislation making gas pipe lines common carriers. The authors list 20 reasons why these two services are incompatible.

Proven Reserves of Mineral Fuels in the U. S.—Valentine R. Garfias, before Am. Inst. Mining Eng., February, 1935.

By "proven resources of mineral fuels" are meant those quantities of coal, petroleum and natural gas contained in underground deposits which it is known can be economically brought to the surface and made available for use. The estimates are necessarily approximate, but they warrant the following conclusions:

(1) that the United States is amply supplied with coal for future needs; (2) that natural gas is available for consumption for the comparatively short time of some 20 years; (3) that the proven petroleum reserves are inadequately small, more so than those of natural gas; (4) that the "law of capture" is the paramount handicap affecting economic oil and gas recovery, and to it can be ascribed the appalling waste of natural gas and the uneconomic recovery of petroleum and natural gas; and (5) that no permanent remedy of these conditions can be expected until the "law of capture" is superseded or basically modified, making possible the economic development and exploitation of oil and gasfields through the "unit plan" of operation or some other similar effective method.

The proven reserves of mineral fuels in the United States are estimated as follows:

	Coal (Million net tons.)	Natural Gas (Trillion cu. ft.)	Petroleum Barrels
1934 production..	390	1,633 (a)	910,051,000
Total production to end of 1934..	21,300 (d)	30,310 (b)	16,600,419,000
Proven reserves at end of 1934....	3,414,550	40,000 (c)	13,000,000,000

(a) Does not include some half trillion cu. ft. blown into the air and wasted in 1934.

(b) Does not include some 8 trillion cu. ft. blown into the air and wasted from beginning to date.

(c) Includes some 10 trillion cu. ft. that will be wasted if production methods continue as at present and if the "law of capture" is not superseded or intelligently modified.

(d) Does not include about 9 billion tons of coal left in the mines or otherwise wasted.

Books

Codigo de Hidrocarburos, Compiled by Manuel A. Alvarado, 1931. 750 pp. English translation bound in one volume: The Oil Code, by J. M. Restrepo-Millan. Editorial, A. J. Posse-Carrera, 6 No. 272, Bogotá, Colombia.

In view of the vital importance of legislation governing oil matters, which has been for years the subject of study both on the part of the Colombian Congress and the Government, Dr. Alvarado decided to make personally a summary but faithful record of the debates held with regard to it by Congress in the extraordinary session of 1930–1931. Dr. Alvarado's purpose was to use the result of that work in his legal practice as a basis for the interpretation of its interesting provisions and for the appreciation of their scope. Being convinced that one of the principal sources, nay the first one, of legal hermeneutics is the knowledge of the original intent, of the spirit in which the legislator adopted the relevant provisions, he has preserved this knowledge in the history of their legislative development.

The present work is the above carried out in the fullest fairness of mind and with no other end in view than to attain the strictest fidelity in grasping the thought of the government and its advisers in the preparation of the bill, as well as of the members of Congress who discussed and voted it.

Since the work is destined especially to lawyers and to outsiders interested in the oil industry, with a view to avoiding the often and difficult search of other laws and provisions that relate to oil laws, the author has taken care of inserting in the proper places all such provisions in force as bear any relevency to the particular point.

In addition to this admirable compilation and references the entire work has been translated into English by Dr. J. M. Restrepo-Millan, official translator of the Ministry of Foreign Relations and rendered fully reliable for its faithful adherence to the original text.

World Oil Production—Official Figures for 1934 and 1935 Revised

All figures furnished direct to WORLD PETROLEUM by Governments, except where otherwise specified

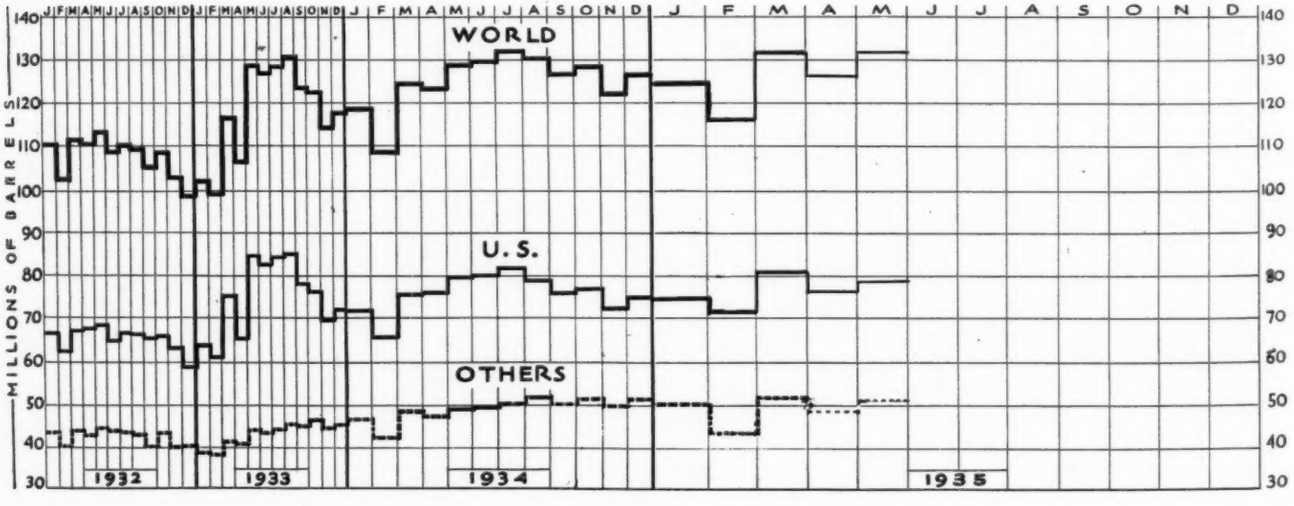
(Figures in U. S. Barrels—Conversion ratio 7 bbl. =1 ton)

Country	June 1934	July 1934	August 1934	September 1934	October 1934	November 1934	December 1934	January 1935	February 1935	March 1935	April 1935	May 1935
United States	80,040,000	81,548,000	79,058,000	75,810,000	76,776,000	72,463,000	74,772,000	78,715,000	72,763,000	81,488,000	78,427,000	79,856,000[1]
Russia	13,966,400	14,297,500	14,287,700	13,924,400	14,260,000	14,388,500	14,638,400	13,358,100	12,704,300	14,139,300	14,058,200	14,280,000[1]
Venezuela	12,500,307	12,193,307	12,505,304	12,381,159	12,591,390	12,274,794	12,420,296	12,818,414	11,287,605	11,703,825	11,869,900	12,175,022
Iraq[5]	11,618,510	12,006,127	12,006,127	11,618,510	12,006,127	11,618,510	12,006,127	425,000	1,631,000	2,258,123	556,500[1]	1,085,000[1]
Roumania	5,178,000	5,223,000	5,556,000	5,335,000	5,467,000	5,324,000	5,522,000	5,355,000	4,860,000	5,256,000	5,008,000	5,320,000[1]
Iran[2]	4,401,223	4,577,251	4,886,462	4,955,419	4,499,530	3,725,178	4,049,556	4,410,714	4,109,665	4,879,000	4,088,000	3,927,000
Mexico	2,918,793	3,303,055	3,434,516	3,276,612	3,393,770	3,332,926	3,425,314	2,894,167	2,661,632	3,519,148	3,120,035	3,529,659
Netherland India	3,577,056	3,678,745	3,456,215	3,410,785	3,577,399	3,553,067	3,743,810	3,716,300	2,630,642	3,640,266	3,533,838	3,492,923[1]
Colombia[4]	1,683,691	1,646,739	1,691,314	1,627,632	1,646,293	1,633,654	1,554,172	1,653,647	1,141,696	1,466,821	1,377,299	1,486,896
Argentina	1,096,855	1,077,502	1,210,273	1,258,812	1,271,186	1,283,811	1,173,998	1,114,235	1,107,420	1,260,468	1,514,968	1,500,000[1]
Peru[4]	1,187,030	1,233,804	1,300,253	1,259,901	1,303,554	1,169,826	1,250,247	1,248,465	1,105,508	1,218,852	1,160,942	1,281,189
Trinidad	947,122	1,008,669	975,697	919,469	906,152	907,635	930,877	915,220	843,619	919,848	899,946	953,108
British India	749,294	785,751	762,959	752,451	779,011	763,091	746,410	700,000[1]	700,000[1]	700,000[1]	700,000[1]	700,000[1]
Poland	304,437	315,861	320,145	311,003	315,000	308,000	308,000	307,000[1]	297,000[1]	309,000[1]	330,000[1]	340,000[1]
Brunei	266,098	271,243	263,781	246,554	225,561	227,815	258,909	269,794	241,927	264,390	263,210	277,550
Sarawak	158,669	164,206	161,504	155,400	156,800	152,600	158,200	183,300	136,500	152,250	151,067	155,400
Japan	125,202	131,397	129,326	124,870	125,229	119,970	131,059	171,441	151,797	164,174	167,728	179,820
Egypt	132,097	135,156	131,061	124,502	123,235	116,326	115,731	112,147	100,086	104,419	94,955	112,685[1]
Ecuador	158,826	141,474	140,944	136,033	141,079	133,490	140,000	147,315	139,555	151,366	145,212	147,245
Canada	109,021	120,772	114,778	114,242	122,056	113,228	117,113	124,654	111,545	120,537	108,506	122,636[1]
Germany[3]	179,480	208,145	219,961	198,366	227,605	219,485	228,767	287,518	223,153	277,942	240,464	265,825[1]
France[1]	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	583,062
Others[1]	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Total	141,419,111	144,188,704	142,733,320	138,062,120	140,034,977	133,949,926	137,811,986	129,048,431	119,068,650	134,114,729	127,673,560	131,846,020

[1] Estimate. [2] Anglo-Persian Oil Co. figures revised; fuel oil returned to the ground has been deducted. [3] Thuringia estimated 7,000 bbl.; official figure for Prussia. Russian Sakhalin included with Russia. Japanese Sakhalin included with Japan. [4] International Petroleum Company's figures. [5] Iraq production estimated for 1934 on basis of total year's production represented by oil shipments through Tripoli and Haifa starting January 1935.

Official Crude Oil Production Figures for 1932 to 1935

	Total 1935	Daily Average 1935	Total 1934	Daily Average 1934	Total 1933	Daily Average 1933	Total 1932	Daily Average 1932
United States	391,249,000	2,591,052	909,107,000	2,490,704	898,874,000	2,462,670	785,159,000	2,145,243
Russia	68,539,900	453,906	168,648,700	462,051	149,901,900	407,950	149,719,000	409,070
Venezuela	59,854,766	396,389	142,072,329	389,239	120,882,802	331,186	119,596,512	326,766
Iraq	5,955,623	39,440	71,921,468	6,607	1,200,000	3,288	1,200,000	3,300
Roumania	25,799,000	170,854	62,006,000	169,879	50,971,200	139,647	50,491,205	137,954
Iran	21,414,379	141,816	52,663,782	144,284	49,581,280	135,840	45,122,455	123,285
Mexico	15,724,641	104,130	38,167,022	104,567	33,904,882	92,890	32,802,285	89,624
Netherland India	17,013,969	112,675	42,289,408	115,861	38,512,663	105,516	39,584,027	108,153
Colombia	7,126,359	47,109	17,340,724	47,509	13,157,127	36,047	16,384,956	44,768
Argentina	6,497,091	33,027	14,045,652	39,015	13,759,565	38,232	13,166,900	35,975
Peru	6,014,956	39,834	14,143,959	38,751	13,923,281 −	38,146	9,899,266	26,026
Trinidad	4,531,741	30,011	10,894,363	29,847	9,560,039	26,192	10,023,780	27,387
British India	3,500,000	13,178	8,997,399	24,650	8,721,665 +	23,893	8,600,312	23,500
Poland	1,583,000	10,483	3,697,617	10,130	3,858,085 −	10,570	3,905,230	10,670
Brunei	1,053,661	8,707	2,673,041	7,323				
Sarawak	778,517	5,155	1,948;044	5,337	2,289,472 −	6,273	2,274,043	6,213
Japan	834,960	5,529	1,484,962	4,068	1,377,761	3,827	1,575,333	4,375
Egypt	524,292	3,472	1,479,037	4,052	1,591,495	4,360	1,742,370	4,760
Ecuador	730,693	4,839	1,655,062	4,534	1,622,624 −	4,446	1,573,857	4,300
Canada	587,878	3,893	1,418,810	3,887	1,147,825 −	3,144	1,054,373	2,880
Germany	1,294,902	8,575	2,266,964	6,211	1,712,823	4,692	1,824,019	4,983
France	767,062	5,079	552,000	1,512	552,000	1,515	552,000	1,508
Bahrein			285,071	781				
Others	375,000	2,483	861,000	2,359	432,000	1,184	432,000	1,180
	641,751,390	4,231,636	1,500,824,474	4,112,381	1,417,534,489	3,884,022	1,296,712,823	3,544,940



World crude oil production in barrels by months, 1932–1935: Ratio of United States crude production to production in all other countries

VENEZUELA

CARACAS, JUNE, 1935.

THE OFFICIAL statement of production and exports of petroleum, as stated in the annual report of the Venezuelan Minister of Industry (Fomento), are given in the accompanying table.

Venezuelan Production and Exports 1934

(figures in metric tons)

Company	Production	Exports
Lago Petroleum Corporation	6,710,341	6,348,676
Venezuelan Oil Concessions, Ltd.	5,238,763	5,248,721
Venezuela Gulf Oil Company	2,558,701	2,886,181
Standard Oil Company of Venezuela	2,540,842	2,337,371
The Caribbean Petroleum Company	2,212,362	1,553,870
Colón Development Company, Ltd.	727,436	719,357
British Controlled Oilfields, Ltd.	125,049	130,632
Tocuyo Oilfields of Venezuela, Ltd.	6,307	1,534
Central Area Exploit'n Company, Ltd.	2,314	
Total	20,112,115	19,226,342

The production of petroleum during 1934 exceeded that of 1933 by 2,818,921 tons; and the amount exported exceeded the exports of 1933 by 2,639,692 tons.

New petroleum companies registered in Venezuela during 1934 were: the Socony-Vacuum Oil Company and the Compañía de Petroleo Lago.

The total number of oil companies registered at the close of the year was 127.

The report of the Ministry gives the following date respecting applications for exploration and exploitation:

Plans of groups and lots of exploration and exploitation approved	72
Plans of deposits and lots for exploitation approved	5
Concessions for exploring and subsequent exploitation approved	16
Titles issued for concessions of exploitation alone	37

The Minister's report further states that twelve titles were issued during the year for exploitation of oil in the national reserves, all to the Standard Oil Company of Venezuela. It also mentions that, although the fixed initial minimum payment for exploitation is 15 bolivars per hectare for surface tax and four bolivars per hectare annually for the first three years, five bolivars similarly for the next twenty-seven years and eight bolivars for the ensuing ten years to the end of the concession, together with 15 percent of the commercial value of the mineral at the point of shipment, the Standard Company had offered to pay the sum of 30 bolivars per hectare for the initial exploitation tax, or twice the fixed minimum.

From reports of exploiting companies, embodied in the Minister's annual report, the drilling situation is given herewith.

Venezuelan Drilling During 1934

	Wells begun	Completed in 1934	In production during year	Productive, but closed
Lago Petroleum Corporation	97	93	326	163
Venezuelan Oil Concessions, Ltd.	53	47	428	236
Venezuela Gulf Oil Co.	4	..	243	228
Standard Oil Co. of Venezuela	76	64	94	34
The Caribbean Petroleum Co.	13	10	139	19
Colón Development Co., Ltd.	9	3	32	...
British Controlled Oilfields, Ltd.	7	2	96	...
Central Area Exploring Co.	..	..	a 1	...
Totals	259	221	1,359	680

As an indication of the gratifying result of the operation of Venezuela's petroleum legislation as respects the national revenue, the following figures of the amounts of taxes paid by the principal operating companies is of interest:

Taxes paid by Oil Companies during 1934

Lago Petroleum Corporation	Bs12,505,076.77
Venezuelan Oil Concessions, Ltd.	11,312,687.20
Standard Oil Company of Venezuela	10,214,111.40
The Caribbean Petroleum Company	7,869,881.45
Colón Development Company, Ltd.	2,296,653.15
Total for the five interests	Bs44,198,409.97

or approximately $11,049,602.49.

The Minister of Industry concludes his summary review of operations of the petroleum companies during the year of the report with the gratifying statement that the relations of the companies with the Federal Executive have been characterized by the greatest cordiality and that the Executive has been pleased to extend to them every facility and guaranty compatible with law.

Amendment of Petroleum Law

THE JUNE number of WORLD PETROLEUM carried an account of the proposed amendment of the Venezuelan law of Hydrocarbons, now pending before the Venezuelan Congress. The impression conveyed respecting the purpose and scope of the amendment in our prior issue is now confirmed, with full knowledge of the change to be effected by the new enactment. The amendment affects only Article 44 of the existing law and the new Article reads as follows:

"The Federal Executive is authorized to stipulate with an applicant for any of the concessions of exploration and exploitation, or of exploitation, to which this law refers, special benefits for the nation in the matter of taxes, increasing, by agreement with the concessionary, the payments which the latter must make in accordance with articles 35 and 36.

"The provision of the foregoing paragraph does not prevent also the grant of such concessions, whenever the Federal Executive may deem it desirable, under the ordinary regimen of taxes established by the aforesaid articles 35 and 36."

C. NORMAN CLARK

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SHIPPING

JOHN BROWN of Clydebank, builders of the QUEEN MARY, have been awarded the long expected contract to build the Anglo-American Co.'s tanker. This ship will be one of the biggest and fastest owned by the company and one of the fastest British-owned ships. Intended for lubricating oil carrying she will carry 27 different kinds, to be handled by 8 cargo pumps, in a hull of 10,200 tons div. the total capacity being 2½ million gals. A Brown-Doyard 2-cycle opposed piston Diesel will give the ship a trial trip speed of 13 knots with 3350 shp.

The presence over here, too, of Socony

© Wide World

The Normandie in New York harbor at the end of her first record breaking transatlantic crossing. The editor of World Petroleum, who crossed from Havre to Southampton on the Normandie, reports that her anticipated consumption of lubricating oil amounted to 610 bbl. supplied by Socony-Vacuum and some 80,000 bbl. of fuel oil for her 175,000 h.p. boilers supplied by Jersey Standard subsidiaries. Mr. Frank A. Howard, president, Standard Development Company, crossed to the United States on the Normandie's maiden voyage.

Vacuum officials from New York leads to the suggestion that a tanker which was spoken of a year or so ago for the Vacuum Oil Company may also be placed. In the meantime a further addition has been made to the big building programme of the Anglo-Saxon Company in the contract which they have placed on behalf of their German subsidiary, Rhenania Company. Two of these ships are being constructed on similar lines to the ANCYLUS class with a capacity of 12,100 tons and 12 knots speed. One of these is to be built by the Deutsche Werft of Hamburg and the other at the Bremer Vulcan yard, Vegesack. The third vessel is to be of the smaller 9,200 tons capacity and will have a speed of 11¼ knots, being constructed at Kiel by Howaldtswerke. It will be recalled that these three yards also participated in the Shell Group tanker construction programme in 1931 and 1934. The new ships are to be built for a German Company and will be registered at a German port and will be manned by German crews. It is pointed out that while the construction will provide employment for 3,000 men for a year, 100 German seamen will find employment in service. This constructional programme of tankers is part of an ambitious programme of the Rhenania Company to increase refinery capacity, to construct tank lorries, etc., the whole programme representing an expenditure stated to be in the neighbourhood of Rm. 12,-500,000. As far as is known, these three new ships will be the first Dutch Shell group large tankers to fly the German flag and to be operated by German crews. Standard New Jersey has adopted the policy of using German flag ships to a much greater extent and the constructional programme now in hand for these people includes several German vessels.

The National Benzole Company will shortly take delivery of a new tanker for coastwise service. This vessel is the third modern motorship recently built for these people and is a dual purpose ship in that she will operate on rivers or canals. Incidentally the canal transportation of petrol is causing an increasing demand for small ships of barge and barge coaster type in this country. The BEN OLLIVER is a cross between the two previous vessels for the National Benzole Company—the BEN HENSHAW and BEN SADLER. She has a superstructure which enables her to operate coastwise and at the same time the bridge is kept sufficiently low so that she can run underneath the Thames and other bridges. All the crew are housed in the poop, as before, which is very high, and there is also a forecastle. The ship is to take the place of a vessel with a similar name, having a carrying capacity of about 88 tons, whereas the new vessel will carry 135 tons. She is propelled by a single screw, driven by an Atlas Polar 2-cycle single-acting airless-injection engine having a scavenge pump attached at the forward end and driven by an extension of the crankshaft. This develops 180 b.h.p. at 450 r.p.m., no reduction gear being fitted, and the ship will have a speed of about eight knots. The cargo pump is to be capable of discharging 75 tons of spirit per hour.

In order to meet the Port of London Authority's specification, the cargo tanks have been arranged in the following manner. There are two centre tanks capable of carrying a total of 100 tons of spirit, and four wing tanks—two on either side—can carry a total of 35 tons of spirit. When the vessel is in the Thames the wing tanks will be gas freed, and so will form the spaces required by the Authority. It is interesting to note that there are to be two separate systems of heating the living quarters, which are arranged aft, from hot water and electricity respectively.

A. C. HARDY.

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British Oil Imports

FEATURE of British petroleum imports during May was the indication of a changing source of crude supplies. Iraq, Mexico and other countries increased their crude shipments to England during the month, but no crude oil shipments were received from Persia, continuing a trend that has been noticeable for the first five months of 1935 during which time Persian crude shipments to England amounted to but a third of the quantity shipped in the corresponding period of 1934. Increased shipments of gasoline and fuel oil from Persia were, however, also a feature of the month.

British Oil Imports

	May 1935	Five months to May 31 1935	Five months to May 31 1934
Lamp oil	387,970	2,477,884	2,868,428
Motor spirit	3,276,514	15,256,057	12,872,374
Lubricating oil	234,573	1,188,030	1,257,970
Gas oil	205,686	1,351,457	1,581,630
Fuel oil	2,176,628	7,853,716	7,133,683
Other sorts	1,629	203,313	307,858
Total products	6,283,000	28,330,457	26,021,943
Crude	1,204,886	5,483,514	5,543,486
Total imports	7,487,886	33,813,971	31,565,429

U. S. S. R.

Official Figures for Soviet Oil Operations

1935	Crude Production (bbl.)	Daily Average (bbl.)	Run to Stills (bbl.)	Drilling (feet)
January	13,358,100	430,935	11,400,000	248,672
February	12,704,300	453,725	10,909,500	334,000
March	14,139,300	456,107	11,714,000	449,417
April	14,058,200	468,609	11,350,000	431,050
May	14,280,000	476,000	11,880,000	442,050
Total 5 Months 1935	68,545,900	453,946	57,253,500	1,905,189
Total 5 Months 1934	68,884,000	456,192	60,297,800	1,736,720
Total 1934	168,648,700	458,042	145,141,000	4,122,898
Quota 1934	214,900,000	585,879	161,000,000	4,950,000
Quota 1935	232,400,000*	636,700	171,500,000	5,214,000

* Including gas; except gas 198,800,000 bbl. of crude.
Crude conversion; seven bbl. = one ton.

THE Fuel division is today the weakest link in the Soviet National Economy. Neither the major Soviet oil fields nor the group of oil fields of lesser magnitude are operating in accordance with the plan. Baku, Grozni and Maikop, in spite of the recently reported improvement in drilling and drilling speed, have not been able to bring sufficient new wells under production in order to check the growing arrears against plan. The arrears of Baku crude production during the five months past have run up to almost 9,000,000 bbl. of which almost half were incurred by all old wells at which production is only a matter of lifting the oil from the pool. Maikop oil fields have fulfilled the plan for 1934 ahead of time, but are at present deep in arrears just as all other Soviet oil fields. The most critical arrears, however, are reported from Grozni. Official reports from Grozni for the first four months of the year show that Grozni has produced 1,800,000 bbl. of crude less than required by the quota for the period and these arrears are exactly 20 percent of the plan.

S. Ordzonikidze, Commissar for Heavy Industries, speaking on operations at Grozni has emphasized the fact that while all other Soviet industrial divisions are forging ahead toward plan fulfillment Grozni oil fields are continuing in arrears. In fact crude production of Northern Caucasus during the five months past shows a decrease of almost 30 percent against the corresponding figure for the same period of last year.

The predominating disadvantage of Grozni today lies in its inability to master the Podnadvig layer which has established oil deposits of high commercial value. During the past four years many attempts were made to overcome the difficulties of drilling at this lower depth, several wells were drilled and completed, having reached the pay, but actual exploitation of the Podnadvig has developed very slowly and it is evident that many difficulties are still ahead. The geological formations and the nature of the strata are not defined as yet and it looks as if the thirty rotary drilling tables operating at old Grozni are only adding to Grozni's drilling expenses. Cave ins at wells are hindering progress and millions of roubles are being spent to alleviate the situation, but without success. Of all 30 new regions of Grozni now drilling only Molgabek has of late made some headway, thus enabling Grozni to augment its statistical showings to 90 percent of plan fulfillment as against 80–82 percent at the beginning of the year.

ZAINDUSTRIALIZATIU (the organ of the Commissariat for Heavy Industries) of May 15th stated that over 30 new regions of Grozni were and still are prospecting with practically no appreciable results so far except at Molgabek. This field is a comparatively new development and successful operations in this new region tend to show that under different working conditions created by the new and more effective management this new development together with several others may enable Grozni to achieve greater success. The fields are well equipped and the outstanding factor for success depends upon the utilization in an effective way of all objective possibilities at disposal. The ZAINDUSTRIALIZATIU article heralded new events at Grozni and following its publication we have received information that S. L. Rosenoer, manager of Molgabek, has been appointed the head of Grozni to replace K. Riabovol. S. H. Gutin, assistant director of Grozni under K. Riabovol, has been made director of Molgabek.

April, May and June are considered the best months for drilling operations in Soviet oil fields. Climatic conditions are very favorable. All roads are passable and fields accessible. This ideal season was expected to give the

Gulf Export Prices for Major Oil Products

Product		Cents per Gallon			
		May 22	May 30	June 7	June 15
Gasoline:	U. S. Motor	4⅝	4⅞	5⅛	5⅛
	64/66–375 E. P.	5	5⅛	5⅜	5¼
	59 Oct. & below	5¼	5¼	5¼	5¼
	65 Oct. & above	5½	5½	5½	5½
Aviation Gasoline:	73 Oct. & above	9½	9½	9½	9½
Kerosene:	44 w.w.	4¼	4¼	4¼	4¼
	41–43 w.w.	4	4	4	4
	41–43 p.w.	3⅞	3⅞	3⅞	3⅞
Gasoil:	26–30 translusc.	2⅞	2⅞	2⅞	2⅞
	30 plus translusc.	3⅛	3⅛	3⅛	3⅛
Fuel Oil:	Bunker purposes (per bbl.)	$1.00	$1.00	$1.00	$1.00
Grade C:	Cargo lots (per bbl.)	$ .80	$ .80	$ .80	$ .80
	Diesel oil (per bbl.)	$1.70	$1.70	$1.70	$1.70
Lubricating Oil:	Bright Stock No. 8	23	23½	23½	24
(New York Export	Bright Stock No. 6½	22½	23	23	23½
Market)	Warren E	19½	19½	19½	20
	600 Unfilt.	15½	15½	15½	16½
	650 Unfilt.	17½	17½	17½	18
	600 Flash s.e.	18½	18½	18½	19
	630 Flash s.r.	23½	23½	23½	24
	Neutral 200 No. 3	28½	28½	28½	28½
	Neutral 150 No. 3½	23½	23½	23½	23½
So. Texas:	300 No. 3 pale	7	7	7	7
	500 3½ pale	7⅞	7⅞	7⅞	7⅞
	750 4 pale	9	9	9	9
	1200 4 pale	9½	9½	9½	9½
	500 No. 5–6 red	7⅞	7⅞	7⅞	7⅞
	750 5–6 red	9	9	9	9
	1200 5–6 red	9½	9½	9½	9½
Crude Oil:	East Texas crude delivered at Gulf port for Export	$1.18	$1.17	$1.17	$1.18

What! FISH WITH A BIT?

The recovery from bottom of bolts, nuts, steel splinters and other small pieces of metal is an easy and inexpensive job with the new Globe Basket Bit.

Its action is almost uncanny in recovering any kind of junk, in pieces small enough to enter the oversize barrel, and the results or savings in a *single* run often are sufficient to pay for the tool.

HOW IT OPERATES

The Globe Basket Bit is in effect a core barrel which cuts a core of enormous size. Narrow teeth on the drill head are tapered and bevelled toward the inside, and when rotation is commenced all junk is forced to the center of the hole. As rotation continues, the Globe Basket Bit quickly cuts a few feet of hole around a large diameter core. The material being fished for is carried on top of the core and into the barrel past the two core catchers which cease to revolve after the dogs have engaged the core. Then by slowly and carefully picking up the bit, the catchers will either:

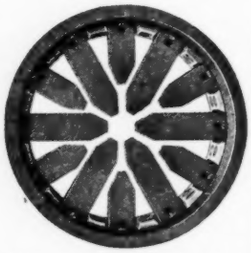
(a) break off the core and bring it out of the hole with the "fish"; or

(b) the dogs will slide up over the end of the core and close under the fish, which is then easily brought out of the hole.

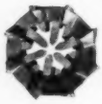
The complete operation is quickly performed, and the ease with which small pieces of junk are recovered will surely earn this tool a place on thousands of tool racks.

The Globe Basket Bit can be used also very successfully for bringing a hole back to vertical; for coring extremely hard formations; as a wash-over shoe when fishing for drill pipe lost in a rat hole; and other similar operations.

The dogs in the upper Catcher, after taking a strong grip on the core or on large objects, do not revolve with the bit head.



Note how the opening is almost closed by the long, close-set dogs in the Lower Catcher which retain bolts, nuts or other small objects.



This end view clearly shows the narrow tapered teeth and indicates the large size core cut; for example,—a 7¼" core in a 12½" hole.

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Typical junk which prevents coring, or starts a crooked hole.
Junk forced to center as Basket Bit is rotated.
Junk past both catchers and on top of core, safely inside the barrel.
Coming out of hole with junk and core held securely inside Basket Bit.

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Soviet fields an opportunity to increase production. As a matter of fact drilling operations were enlivened considerably against last year, the technical showings of drilling have likewise improved over last year and the drilling speed has been increasing from month to month. The average speed of drilling per table per month has increased to 930 ft. against 712 ft. last year and considerable progress has been attained in utilization of proper drilling in percent to the total time of drilling operations. This has grown from 22 percent in 1933 to 27 percent in 1934 and to 33 percent at present at Baku. The corresponding figures for the first five months of 1935 for all other Soviet oil fields are 23 percent at Grozni and Maikop, 29 percent for Emba and 26–32 percent for Vostokneft. The drilling distance attained per single drilling operation of one bit has increased from 50 ft. in 1934 to 60 ft. during January, 69 ft. during February and March and 83 ft. at present. This has naturally tended to increase drilling speed, but the quality of drilling measured by the number of wells completed for production still remains low. During the first quarter of 1935 only 126 wells were completed at Baku against 160 wells required by the plan and 21 wells against 37 planned were completed at Grozni. The cost of drilling is exceeding the original estimates. The excess of drilling expenses against plan have amounted to over 22,000,000 Rbl. in 1934 and the corresponding excess for the first quarter 1935 amounted to over 3,000,000 Rbl.

Plan Fulfillment

	all Soviet oil fields	Baku	Grozni
May 1935	90.2 percent	91.7	88.5
April 1935	87.0	90.9	89.6
May 1934	83.0	90.7	89.0

For several years past Soviet engineers have followed closely all new developments and oil field practice in the United States. During 1928–1931 they placed large orders for drilling and production equipment with American manufacturers which resulted in considerable increases of Soviet crude production. The plans were lived up to and even exceeded. The first Five Year Plan was completed in 2½ years. In 1932 the Soviets stopped all importation of oil field equipment from abroad and undertook to replace imports by domestic design and manufacture. There followed stabilization of Soviet crude production. Since 1932 new developments in oil field practice have taken place in the United States but the Soviets are not taking advantage of these improvements. It takes Soviet representatives over 12 months to study new developments in the United States and it takes another 18 months for the higher authorities at Moscow to make decisions for placing the orders and to have the orders executed.

AT A PLENARY meeting of the Advisory Board of the Commissariat for Heavy Industries at Moscow under participation of representatives of all branches of Soviet Heavy Industries the following colloquy took place between S. Ordzonikidze, Commissar for Heavy Industries and Peterson, head of Baku oilfields.

Peterson: The Soviet oil industry has not

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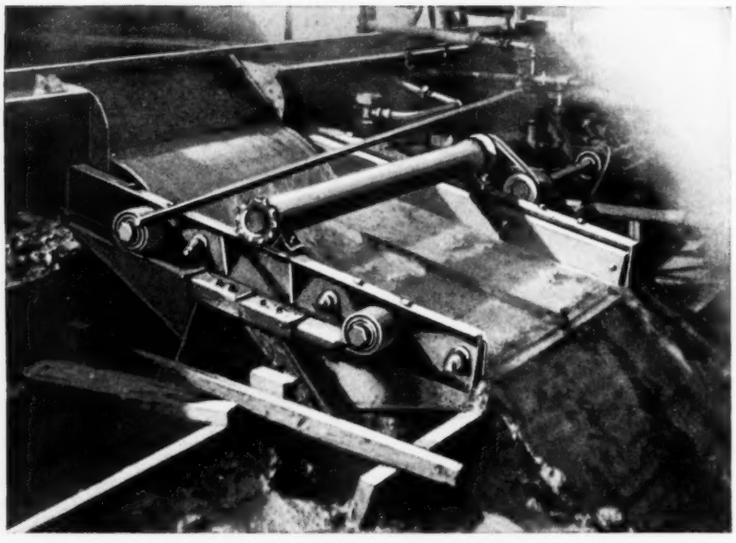

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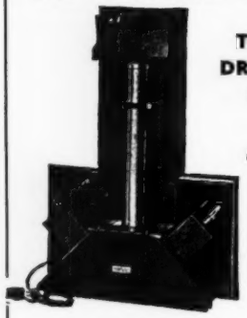

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been able to live up to plan fulfillment in 1934 and all signs are that it will not be able to do much better in 1935. This is true in regard to quality as well as quantity indexes and particularly to cost of operation. The heads and superintendents of the various divisions do not seem to pay much attention to the matter of expense accounting. Irrespective of our vigorous criticism on the subject, no progress has been made in reducing the cost of operation and the planned estimates are being exceeded in drilling as well as in production.

Ordzonikidze: What about progress in speed of drilling?

Peterson: We have exceeded the plan during the first quarter of 1935, however at what cost. We have exceeded the planned estimate of cost of drilling about 22,000,000 Rbl. during 1934. We have exceeded the estimates for drilling expenditures over a period of past years and we still continue doing so without appreciable returns. Our drilling operations are of inferior quality and the quality of drilling is the thing that counts. The growing frequency of breakdowns at wells in drilling is hitting hard our progress and I think that we shall have to alleviate this short-coming by measures of an economical nature; namely we shall set special rewards for quality and for this we need an adequate personnel. We further have to pay more attention to auxiliaries, which at present do not correspond with our requirements. Our repair shops are not up to date. They are not adequately equipped for special jobs and neither are the shops manned by specialized or individually skilled labor. Unless we undertake vigorous steps of rationalization our cost of operation will be exorbitantly high in every direction and in this direction we have a great deal to change and to improve. The average service per mechanical lathe in Soviet repair shops requires 41 individual handlings by various expert mechanics and there is undoubtedly a way to place several operations in the hands of one highly specialized expert mechanic.

Ordzonikidze: What about breakdowns at wells in drilling?

Peterson: A great many breakdowns could be eliminated by means of improving the quality of casing and drilling pipes. Over 74 percent of breakdowns at wells during the first quarter of 1935 were due to inadequate pipe used and 30 percent of the breakdowns were caused by low quality of pipes employed.

Ordzonikidze: What has been done to improve the quality of pipes?

Peterson: We have found that the quality of pipes has been improved in regard to those which are required for deep drilling, but for such drilling extraordinary specifications are required and exactly here we are still short of the required standards.

Mr. Peterson further reported that in regard to cost of operation only the Lenin group of fields and to some extent the Ordzonikidze fields have lived up to estimated figures while all other oil field groups have exceeded the plan at the rate of from 18 to 20 percent.

In regard to the problem of transportation Mr. Peterson reported that much has been done to remove the evil of shortage of facilities, but other difficulties have turned up in the form of making full use of the facilities at disposal.

Ordzonikidze: What is the present average of crude production?

Peterson: 55,500 tons (385,000 bbl.) of crude per day at Baku.

Ordzonikidze: How does this compare with the quota?

Peterson: The plan calls for 60,400 tons (422,800 bbl.) per day.

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Ordzonikidze: Do you expect to live up to planned production?

Peterson: This depends entirely upon the successful completion of new wells which are at present under drilling and indications are at hand that several wells are due shortly for completion. These may enable us to live up to plans.

Soviet Oil Exports

	First Quarter 1935 tons	First Quarter 1934 tons
Total	845,641	1,022,477
Gasoline	187,911	268,988
Value	Rbl. 10,270,000	Rbl. 15,187,000

Soviet Diesel Building

THE BUILDING of Diesels in prewar Russia dates back to 1890 when the Works "Russian Diesel" controlled by Nobel Bros. acquired a license on the patents of Rudolf Diesel of Germany and were the first and only builders of Diesel engines. Nobel Bros. were the first to introduce Diesel engines into shipping on the Volga river and in the Caspian oil trade. In 1904 the "Kolomna Works" of St. Petersburg undertook the building of Diesels on a large scale and since the October Revolution, Diesel building in U.S.S.R. has been taken up by the "Sormovo Works", "Dvigatel Revolutii" plant and "Marti Shipbuilding Yards" at Nikolayeff.

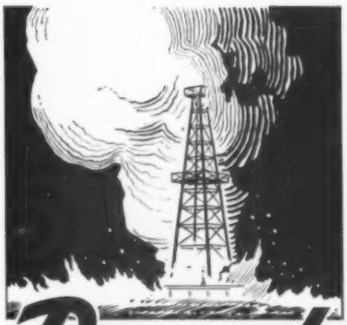
The total output of Diesel engines in prewar Russia aggregated about 200,000 HP. and a total of 325,000 HP. were built in Russia in other types of internal combustion engines. The bulk of Russian requirements were covered by imports. Diesels were imported from Germany and other internal combustion engines from England and Sweden.

Soviet Diesel building caught up with the prewar level in 1928 and during the First PIATILETKA period the Soviet domestic plants built about 465,000 HP. of Diesels and about 540,000 HP. of other internal combustion engines; in addition, some 150,000 HP. of Diesel engines were imported from abroad.

Today there are eleven individual Soviet domestic machine shops which are building Diesel engines as well as engines for internal combustion. Most of these are of 2 and 4 cycle types as 4 SD 19–32 and 4 RD 24–38. Several other types are in operation, which being over aged or even obsolete for further construction, are expected to be discontinued.

Most Soviet types of internal combustion engines are of rather primitive design and consume between 350 and 400 grams of oil per HP. (416 grams=one lb.). The future development of the Diesel industry of Soviet Russia will largely depend upon the progress of the Soviet oil industry. While Diesel engines can be adjusted for a wide range of fuel necessary provisions are required for a thorough cleaning and preheating of the same and it is very important that the grade of fuel should be constant and uniform in the nature of gravity properties and specifications. The Soviet oil industry has yet to achieve such standards.

Soviet Diesel building is being concentrated on construction of tractors in order to substitute gasoline by heavy motor fuel for all heavy duty vehicles and the contests of 1934 undertaken by Soviet Russia with Diesel driven



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vehicles show that such reconstruction is practicable. During the past four years experiments were made in the design and construction of stream evaporation Diesels such as Yunkers, Renault, Lilloise, Mann, Birdmore, Mann 110 types and forechamber types as Mercedes Bentz Z.OM.55 & OM 59, Ganz, Bussing, NAG., Deutz, Hanomag. Similar experiments were made with Acrochamber and Whirlwind chamber types of AEG., Sauer, MWM., Crossley, Fiat, Thorncroft, Perkins and others.

In regard to cylinders the choice of the Soviets seems to rest upon a decision to use 4–6–8 cylinders in order to enable interchange and plans are being made for building as indicated in the accompanying table.

Type of Diesels Built at Leading USSR Plants

	Capacity HP.	RPM.	Weight (Kg.)
Stalingrad Plant 3-ton trucks	65– 75	1,800–2,200	450– 550
Yaroslavl Plant 5-ton trucks	90–110	1,800–2,200	600– 800
Cheliabinsk Traktor Works	65– 75	650– 800	900–1,100
Stalingrad Wheel & Caterpillar Tractors	40– 55	1,100–1,300	450– 550

These four types are scheduled for serial production and standardization of design in order to enable the interchange of cylinders from 4 to 6. This will also make it possible to use the motors for road building machinery, motor boats, etc., and the two cylinder type will find wide application in agriculture. Experiments were made at Stalingrad with the design of pumps and burners and at Samara with carburetors.

According to the plans of the Second PIATILETKA for consumption of fuel, the program of Soviet Diesel building calls for 1,253,000 HP. in 1935, 1,704,000 HP. in 1936, and 2,002,000 HP. in 1937.

Distribution of Diesels to the various industries of Soviet Russia are planned as follows:

MERCHANT MARINE. Sea and river transportation were getting exactly 35 percent of all oil burning engines during the period of 1931 and 1934. During the years 1935 and 1937 this ratio will decline to 33.4 percent, but demand for Diesels for water transportation is to grow from 404,000 HP. during the period 1931/34 to 657,000 HP. in 1937.

RAILROADS. This department of transportation is gradually increasing the use of Diesels. During the period 1931/34 a total of 115,000 HP. of Diesel engines were acquired, the corresponding figure for 1937 will be 541,000 HP. or 27 percent of the total output.

AGRICULTURE. The requirements will amount to 350,000 HP. in 1937.

Other industrial uses of Soviet Russia will take 266,000 HP. of Diesels in 1937.

Total Soviet Diesel Requirements in 1937

Capacity HP.	Total HP.	Percent of total
6– 12	90,000	4.5
15– 40	451,000	22.6
50– 75	292,000	14.6
100–150	231,000	11.5
200–400	296,000	14.8
600–800	186,000	9.3
1,000 and over	455,000	22.7

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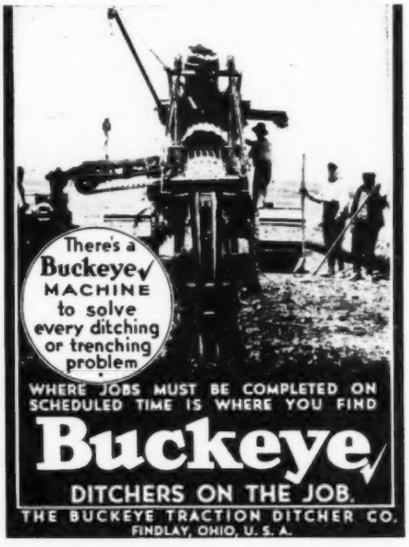
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